



IMPERIAL BUREAU OF PLANT GENETICS: HERBAGE PLANTS

BULLETIN No. 4.

ABSTRACT-REVIEW OF LUCERNE LITERATURE DURING
PERIOD 1925-30

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ABERYSTWYTH,
WALES.

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I. INTRODUCTION.

A bibliography on lucerne literature was promised in our Circular Letter No. 1. issued in January, 1930, but has been necessarily delayed considerably until other more urgent matters in the work of the Bureau had been dealt with.

In the preparation of this Bulletin, the choice lay between an extensive bibliography with little indication as to the content of the separate papers and a collection of abstracts selected from the literature of a certain period which would give to the general reader an indication of the type of problems studied and results obtained, and to the specialist a suitable starting point in the examination of the literature on any special point. The latter method has been adopted, as many of our overseas readers are situated away from suitable library facilities and may appreciate having more information than could be supplied in an extended title.

It is possible that by accident or intent certain important references to literature published during the period 1925-30 may have been omitted. Especially will this be the case with the American literature, such as Experiment Station Bulletins, etc. In this connection it may be mentioned that Stewart's book on lucerne listed in Section XIII. gives a comprehensive list of American publications previous to 1926.

In the compilation of Sections V., VI., and VII., the Imperial Bureau of Soil Science was consulted; as regards Section VIII., Dr. Orr has kindly advised us that the references on the nutritional aspect of lucerne, from the point of view of the plant, are probably complete.

Any person wishing to receive further references on lucerne from any of the aspects dealt with in this Bulletin should apply to this Bureau for such assistance. The progress of studies on lucerne subsequent to the period covered by this bibliography will be discussed in the quarterly numbers of Herbage Abstracts, as material accumulates.

The Bureau is much indebted to Professor Wm. Southworth, late of the University of Manitoba, for valuable assistance and advice in the preparation of abstracts.

II. BREEDING, CYTOLOGY AND EMBRYOLOGY.

CHRISTOPH, K. Untersuchungen an *Trifolium pratense* L. und *Medicago sativa* L. [Researches with *Trifolium pratense* L. and *Medicago sativa* L.] Z. Pflanzenz. 11. 23-40. 1925. 633.31 : 575

Investigations with *Medicago sativa*.

1. The breeder must in the selection of plants direct his aim to abundant flower formation, as the inflorescences are the parts richest in nutriment.
2. The proportion of leaf must be as high as possible.
3. Further, such plants are valuable as have the ability to form many lateral branches of which again the upper are richer in nutriment than the lower.
4. The proportion of the main stems is to be kept as low as possible, as these are the parts poorest in nutriment. Possibly through breeding for fineness of stem the main stem might be rendered more delicate and richer in nutriment.

FLEISCHMANN, Rudolf. Pflanzenzüchterische Betrachtungen am Luzerneblatt. [Plant breeding observations on the lucerne leaf.] Pflanzenbau. 3. 97-99. 1926. 633.31 : 581.45] : 575

The author is concerned with the breeding of lucerne for dry situations, as the Kompolt Plant Breeding Station is situated in a dry zone. General observations are made on the arrangement, form and size of the lucerne leaf and the relation of the leaf movements to the control of transpiration, this last point being important in the hot and dry Hungarian climate.

FLEISCHMANN, Rudolf. Beitrag zur Züchtung der ungarischen Luzerne. [Contributions to the breeding of Hungarian lucerne.] Z. Pflanzenz. 11. 211-240. 1926. 633.31 : 575

After a preliminary separation of forms, inbreeding by means of artificial self-fertilization and extension of the technique (vegetative propagation) were adopted. The introduction of a performance test to which exception would not be taken was a difficult matter. Variation was found from flower to flower in the case of operation of the explosive apparatus, connected with a greater or less setting of seed. For practical purposes, a grouping of the forms according to flowering behaviour has proved very important, as a series of other important processes are connected with the time of flowering. The early flowering are distinguished by a rapid development rate, usually produce many flowers, and give large crops of seed but less green weight than the late flowering, the economy of which is adapted to the formation of a large "body," thus more green produce at the expense of seed production.

The chief part in the pollination is played by the honey bee. Natural self-fertilization occurs frequently. The degree of twisting of the pods was recognised as a typical character in many forms.

Fructification is correlated with green production :

$\frac{\text{Seed yield } 100}{\text{green yield}}$ of this proportion appear to be well inherited. Results of the cultural trials with bred lucerne are communicated. As regards hardness of seed in the bred forms, a diversity of this character was found according to strain, with, however a definite influence from weather conditions.

633.31 : 576.3

633.366 : 576.3

633.373 : 576.3

FRYER, James R. **Cytological studies in *Medicago*, *Melilotus* and *Trigonella*.**

Canad. J. Res.

3. 3-50. 1930.

A cytological study of the relationships of species and varieties within the genus *Medicago* was attempted, and comparisons made between this genus and the related genera *Melilotus* and *Trigonella*. The present unsatisfactory taxonomic situation is discussed and the value of cytological study as a means of elucidating taxonomic difficulties emphasised. The somatic chromosome morphology for 23 species and five varieties of two additional species of *Medicago*, for four species of *Melilotus* and for three species of *Trigonella* are recorded. The following questions are also dealt with:—chromosome numbers and the annual or perennial habit in *Medicago*, hybrid origin of *M. media*, taxonomic relations of *M. lupulina*, *M. carstiensis*, *M. obscura*, *M. rigidula* and *M. arabica*, and varieties of *Medicago hispida*. In general it is concluded that these cytological studies have yielded information which can be utilized very effectively in clearing up some of the taxonomic problems, particularly in the genus *Medicago*. It is predicted that the cytological information will also be useful to plant breeders who may contemplate inter-specific hybridization among any of the species studies.—*From author's abstract.*

633.31 : 576.312.32

GHIMPU, V. Contribution à l'étude caryologique du genre *Medicago*. [**The cytology of *Medicago*.**] *Compt. Rend. Acad. Sci. [Paris]* **187**. 245-247. 1928.

The chromosomes in the cells of root tips in 14 species of *Medicago* were uniform in size and rod-shaped. The different species studied were arranged according to the 2n number and dimensions of the chromosomes as species having 16 large, 16 medium, 32 medium sized, or 32 small chromosomes.—W. H. Emig. *Biol. Abs.* 4. 308. 1930.

633.31 : 576.3

GHIMPU, V. Recherches cytologiques sur les genres *Hordeum*, *Acacia*, *Medicago*, *Vitis* et *Quercus*. [**Cytological research on *Hordeum*, *Acacia*, *Medicago*, *Vitis* and *Quercus*.**] *Arch. Anat. micr.* **2**. 1930.

The author has studied the cytology of 33 species and varieties of *Medicago*. The haploid numbers found are invariably either 8 or 16. The only species reported with the latter number are *Medicago arborea*, *M. falcata*, *M. sativa* and *M. scutellata*.

633.31 : 576.16

LIEBER, R. Morphologische und pflanzenzüchterische Betrachtungen über die Luzerne. [**Morphological and plant breeding observations on lucerne.**] *Landw. Jahrb.* **68**. 117. 1928.

From evidence relating to growth, flower colour, leaf structure, thickness and colour of stem, etc., it is concluded that old Franconian lucerne is a hybrid form. Dark flowers, broad leaves, thick stems and absence of reddish coating are correlated with high yield. A negative correlation, not so great as is generally assumed, exists between green yield and seed yield.

633.31 : 576.354.5

REEVES, R. G. **Nuclear and cytoplasmic division in the microsporogenesis of alfalfa.** *Amer. J. Bot.* **17**. 29-40. 1930.

At early prophase, the chromatin is in the form of a network occupying, with the nucleolus, the entire nuclear cavity. The thread becomes bivalent during synzesis, its double nature being recognisable in all subsequent stages. The haploid chromosome number is 16. There is a complete reorganization of the daughter cells at interkinesis, several nucleoli being formed. No cell plates are formed after either division, ingrowing ridges on the pollen mother cell wall, accompanied by slight vacuolation, delimiting the members of the tetrad. Division of the nucleus of the pollen grain occurs before pollen is shed. The generative nucleus then becomes surrounded by a lens-shaped region of cytoplasm and takes a position on one side of the pollen grain.

REEVES, R. G. Development of the ovule and embryo sac of alfalfa. *Amer. J. Bot.* 17. 633.31 : 581.32/3
239-246. 1930.

The general curvature of the ovules in *Medicago sativa* is towards the base of the ovary, although pressure of the carpel wall may cause one of the upper ovules to curve towards the stylar end. The archesporium may consist of one or of several cells. The parietal tissue usually consists of a group of cells. Several tetrads may be formed but only one embryo sac matures, having developed from the chalazal megaspore of a tetrad. The embryo sac is eight-nucleate, rarely six-nucleate. The antipodal cells disappear very early. Partial fusion of the polar nuclei was observed in embryo sacs in which fertilisation of the egg-cell had not yet occurred. The mature embryo sac is long and somewhat curved, and obtains nutriment chiefly by the digestion and absorption of adjacent tissues.

633.31 : 576.3
633.3 : 576.312.35
TSCHECHOWA, W. Karyologisch-systematische Untersuchung des Tribus Galegeae, Fam. Leguminosae. [Cytological and systematic examination of the tribe Galegeae, Fam. Leguminosae.] *Planta*. 9. 673-680. 1930.

The following numbers are reported for the genus *Medicago*: *M. hispida*=7; *M. lupulina*=8; *M. lupulina* var.=16; *M. sativa*=16.

633.31 : 575] (48.5)
633.31 : 31.531.12] (48.5)
TORSELL, R. Möjligheterna för luzernens förädling och fröodling i Sverige. [Possibilities of lucerne breeding and lucerne seed production in Sweden.] *K. Landtbr. Akad. Handl. Tidsk.* 69. 187-209. [English summary, p. 210.] 1930.

633.31 : 581.162.51
TORSELL, R. Självsterilitet hos luzern. (*Medicago sativa* och *M. media*) [Self-sterility in lucerne. (*Medicago sativa* and *M. media*).] *Ber. Jordbrugsforskeres Foren. Fjerde Kong.* p. 666-669. København, 1929.

Lucerne flowers not selfed i.e. (not tripped) and then isolated in a bag of parchment or closely woven cloth (with very rare exceptions) failed to set seeds.

Flowers isolated under similar conditions but tripped gave favourable results. Among 135 isolated plants from various populations, not a single individual was found to be absolutely self-sterile when flowers were tripped. It was found however that by cross-pollination as compared with tripping (self-pollination) fertility was greatly increased. In one experiment with so-called *Medicago media* there was 50 per cent. increase in number of seed pods formed in favour of cross-pollination, while Grimm Lucerne under similar treatment gave an increase of 20 per cent.

It appeared that when unrelated plants were crossed the resulting progeny only in very exceptional cases resembled that obtained by selfing the same parents.

To test the effect of in-breeding on self-sterility 764 flowers selfed on 5 parent plants were compared with 806 selfed flowers on plants of their F_1 progeny. The results show that the 5 parents gave an average of 57.1 flowers fertile and F_1 progeny 12.6 per cent.; or a decrease of 44.5 per cent.

Another test to compare the fertility of a selected parent with F_1 : F_2 : F_3 in-bred progeny showed a rapid decrease in each of the three generations. Taking the fertility of the parent as 100 : F_1 =35 : F_2 = 27 : F_3 = 4. —W.S.

633.31 : 575.061.6
WALDRON, L. R. Vererbung der Blütenfarbe bei Hybriden von *Medicago sativa* und *Medicago falcata*. [Inheritance of flower colour in hybrids of *Medicago sativa* and *M. falcata*.] *Pflanzenbau*. 6. 157-166. 1929.

(1) *Medicago sativa* and *M. falcata* were crossed and flower colour studied in three generations. Colour notes were made at four stages of flowering, the nomenclature based on Ridgeway's colour tables.

(2) Plants of the F_1 generation show their heterozygous nature as regards colour quite distinctly, when the plant is hybrid to any extent for this character. This fact may be connected with two colours, yellow and violet, being produced by colour plastids or coloured cell sap.

(3) Dominance seems to be entirely lacking, although the phenotypical action of individual and perhaps smaller colour factors is still unknown. It would follow in consequence that on segregation the ratio of homozygotes to heterozygotes would be as follows :— 1:1, 1:3, 1:7, 1:15, 1:32, 1:63, etc.

(4) As regards flower colour in 228 F_2 plants, three were undoubtedly yellow and eight violet. The F_2 segregation suggests a genetic formula with a trifactorial basis ; the use of the chi-quadrat formula is unsatisfactory. The F_2 segregations agree better with the hypothesis of three factors than with two or four.

(5) The flower colour in F_2 plants was so varied that it was impossible to divide them into sharply differentiated groups.

(6) F_3 descendants of nine F_2 plants were obtained. Two of these, from parents undoubtedly homozygous in flower colour both on the *sativa* and *falcata* side, proved to be pure lines. The presence of only two vicinists among 437 plants where vicinism was to be expected, shows that vicinism in all the flowers was too slight to influence ratios to any degree.

(7) The ratios found in the seven segregating F_3 families show a complex genotypical position as regards flower colour and admit the possibility of at least three factors governing colour. The F_3 families were too small for one to decide whether more than three factors were present. The F_3 families with the higher ratios show no satisfactory agreement with the ratio 1:63.

III. VARIETY AND YIELD TRIALS.

633.31 : 631.531.23

633.321 : 631.531.23

CHMELAR, Frant and MIKOLASEK, Fr. Versuch der Reihenkultur bei Rotklee und Luzerne.

[A trial of growing red clover and lucerne in rows.] *Bull. Czech. Acad. Agric.* **6.** No. 2. 1930.

(1) The two-cut Bohemian red clover reacts to an increase of standing room per plant with an increase in green mass, not, however in the same ratio. When the area was increased fivefold (from 50 to 250 cm²) the aerial plant weight increased by only three times.

(2) With increased standing room the structure of the plants altered to some extent, in that somewhat more stem developed (about 2 to 3 per cent.), whilst the flower weight remained almost unchanged.

(3) Lucerne showed more marked reaction to increased standing room than red clover, but again not in the same ratio. When standing room was increased by six times, the increased green mass production amounted to nearly five times.

(4) The structure of the lucerne plants was less affected than that of red clover, stem percentage increasing by from 1 to 2 per cent. only.

(5) The advantage of sowing red clover and lucerne in rows right across the cover crop (already up) is that the clover shoots better and more evenly in the somewhat encrusted soil than when broadcast, because the crust is more easily penetrated in the seed rows.

(6) With poor seed it was found advisable to sow out red clover and lucerne simultaneously with the main and cover crop; when there is a fairly large distance between the rows this facilitates the hoeing of the cereal also.

(7) In the case of red clover, the best method of sowing appears to be machine-sowing in rows about 12.5 cm. apart.

(8) The sowing of red clover in rows 25 cm. apart, which allowed of hoeing, as a rule gave a somewhat lower yield of green mass, and it will have to be further investigated whether this method might be used for seed production, whereby the distance might possibly be reduced to 20 cms.

(9) Trials of lucerne show that broadcasting gives a somewhat higher yield in the first year than row sowing (15 to 22.5 cms.) and a much higher yield than sowing in rows 30 cms. apart. It will be necessary to keep the stands under observation in future years, as the surplus weight of the hoed stands cannot be noted until later, especially on heavy soil inclined to become overgrown with weeds. The smallest distance which will permit of hoeing and weeding between the rows must also be ascertained.

633.31 : 576.16

FLEISCHMANN, R. Versuche mit verschiedenen Luzerneherkünften. [Trials with lucerne of different origin.] *Pflanzenbau.* **6.** 18-21. 1929.

Results are presented from yield trials, in which local Hungarian strains were compared with foreign strains from all parts of the world. Two tables are supplied, giving yield in kg. green weight per 20 m. rows.

633.31 : 576.16

KIESSELBACH, T. A., ANDERSON, Arthur, and PELTIER, G. L. A new variety of alfalfa (Hardistan). *J. Amer. Soc. Agron.* **22.** 189-190. 1930.

The source of the seed of this new variety was an old superior field of alfalfa which, 16 years after sowing, showed a practically perfect stand. Hay-yielding capacity was determined over a seven-year period; this showed a 4 per cent. superiority over Nebraska Common, compared with five per cent. superiority for the Grimm variety. A markedly superior, full and uniform stand eight years after sowing is good evidence of winter-hardiness. Wilt infection data in 1928 showed 71 per cent. infected in Nebraska Common, 67 per cent. in Grimm and 28 per cent. in Hardistan. In appearance and growth Hardistan closely resembles the Common variety. Although supposed to be originally Turkestan, it does not show the typical characteristics of Turkestan lucerne.

KLINKOWSKI, M. Das biologische Artbild der Luzerne. [The specific character of lucerne from a biological point of view.] *Ernähr. Pfl.* **26.** 394-399. 1930.

The origin and migrations of lucerne are dealt with. *Medicago sativa* is a native of the temperate districts of Western Asia, of Media, the countries south-east of the Caucasian highlands and the north-western part of modern Persia. At a height of 1500-2000 metres in Turkestan in dry crumbling soil, the original wild form of cultivated lucerne has been found. It therefore comes from the continental steppes with a late spring and a short hot summer, where the vegetation is almost exclusively halophytic. The usual story of the migration westward is given, and *Medicago falcata* is then traced back to Northern Asia, probably West Siberia.

Lucerne was unknown in North America until it arrived simultaneously, in the middle of the 19th century, from Chile through California and from Mexico by way of Colorado. *Medicago sativa* was unsuited to the climatic conditions of the North and it was not until the arrival of the hybrid Grimm lucerne from Germany that cultivation of this crop attained any importance in North America.

633.31 : 581.9

633.32 : 581.9

KOUSNETZOFF, V. Areas of the geographical distribution of the most important forage species of clover and alfalfa. *Bull. Appl. Bot. Leningrad.* **16.** No. 1. 55-88. [English summary, p. 87.] 1926.

Maps have been drawn up showing that the areas of distribution of *Trifolium* and *Medicago* are distinctly Mediterranean, as the majority of the species are concentrated in this region. The centre of origin must also be sought in this region as their areas of distribution are either typically Mediterranean, or extensions from this centre to the North or to the East of the Eurasian Continent.

633.31 : 576.16

MUELLER, H. C. Luzerne-Sortenversuche der Agric.-chem. Kontrollstation Halle. [Lucerne variety trials at the Halle Control Station.] *Proc. Int. Seed. Test. Ass.* No. 11-12. 135-136. 1930.

In the trials of lucerne of different origins carried out by the author during the last few years, Thuringian lucerne, as will be seen from the appended summary, gave the highest yield. It is better suited to the soil and climate than varieties of foreign origin; it is also superior to the Old Franconian lucerne, although conditions of growth are similar in both cases.

Five cuts were taken from trial field No. I and six cuts from trial field No. II. In the following table the yield for one year is calculated on a uniform dry substance content of 85 per cent.

Mean yield of hay with 85 per cent. dry substance, per Morgen.

Origin.	Trial Field No. I. (two cuts) Centners.	Trial Field No. II. (three cuts) Centners.
Thuringian	33.80	43.23
Franconian	31.34	39.75
Pfalz	30.70	37.47
Hungarian	29.86	38.34
Provence I.	27.46	37.08
Provence II.	25.52	34.20
Spanish	22.68	28.47
Argentine	22.16	26.91
Cape	20.04	25.02

633.31 : 631.557

ZORN, W. and CHRISTOPH, K. Ergebnisse vierjähriger Luzernesorten-und mischungsversuche. [Data from four-year trials with lucerne varieties and mixtures.] *Deuts. landw. Pr.* **1.** 139. 1929.

IV. SEED PRODUCTION.

CALIFORNIA UNIVERSITY COLLEGE OF AGRICULTURE. 633.31 : 631.531.12
Alfalfa varieties and seed supply. By B. A. Madson. Circular No. 38. 1929.
 VARIETIES OF ALFALFA.

The Common or Chilean alfalfa imported in the early fifties is the most important and probably constitutes 80 per cent. of the alfalfa grown in California. In general it meets the soil and climatic conditions in nearly all parts of the State, it yields well and produces feed of excellent quality. *Hairy peruvian* alfalfa was introduced about 1905. One of its chief virtues is ability to grow at a lower temperature than Common; hence it starts growth earlier in spring and continues later in the fall and in a mild winter may make a continuous growth for pasture. The chief drawbacks in this variety are coarseness of stem with a less percentage of leaf and a shorter life than Common alfalfa; the presence of dense coarse hairs is also objectionable. *Peruvian* is grown with advantage for winter pasturage in the extreme South of the State.

Grimm Alfalfa has been grown but only to a very slight extent. Owing to its long dormant period in winter this variety is not so suitable for crop production in California as the above named varieties, and present information indicates that it cannot be recommended for general use.

SOURCES OF SEED.

Winter hardiness in California is not necessarily a virtue and the winter hardy strains, having a long period of dormancy, have a shorter growing season and a lighter yield than the less hardy strains developed in milder climates; hence imported seed is never to be recommended as long as good local seed is available.

As regards the characteristics of good alfalfa seed, freedom from weed seeds is strongly emphasised and the need for better state control to safeguard the buyer is discussed both as to purity, germination and origin of seed offered for sale.

As a means of securing pure varieties it is suggested that those kinds which are at present under cultivation should be subjected to a rigorous selection and the best strain thus obtained grown under a properly organised system of field inspection and certification.—W.S.

CARLSON, John W. 633.31 : 581.141
Seasonal behaviour of alfalfa flowers as related to seed production.
J. Amer. Soc. Agron. 20. 542-556. 1928.

Some stripping of alfalfa flowers is of common occurrence. The pods are also known to strip. Of 2,042 racemes studied, 82.1 per cent. possessed pods with mature seed at harvest time. On the average, 34.2 per cent. of the flowers on individual racemes formed pods, while the remainder stripped. The percentage of flowers stripping from the individual racemes is proportionally greater and of more consequence from the standpoint of the seed crop than is the complete stripping of flowers from part of the racemes. When alfalfa flowers were stripped by artificial means, 63.9 per cent. formed pods as against 37 per cent. when the flowers were allowed to develop naturally. When flowers were allowed to develop naturally, 10.8 per cent. were found to have become tripped, while 37 per cent. formed pods; alfalfa flowers are therefore capable of forming pods rather freely in the absence of tripping. Under natural conditions of development many-flowered racemes formed proportionally more pods than did few-flowered racemes. Under conditions of artificial tripping the reverse held true. On the average, when alfalfa flowers are 1-3 days in the full-bloom stage and 2-5 days in the wilted stage, the chances are greatest that they will form seed pods. If the flowers remain in the fresh-looking full-bloom stage for many days without showing a tendency to wilt or if they remain in the wilted condition unduly long the chances are very great that they will strip before forming pods.—*Author's summary.*

CARLSON, John W. **Artificial tripping of flowers in alfalfa in relation to seed production.** 633.31 : 581.141
J. Amer. Soc. Agron. **22.** 780-786. 1930.

Generally, artificial tripping will increase the percentage of flowers producing pods in the ratio of 1 : 2.5 as compared with normal development. The seed pods formed by artificial tripping attain to normal maturity and are fully equal to those produced naturally. Results suggest that artificial methods influence towards greater stability and regularity in the subsequent behaviour of the flowers. Untipped flowers tend to be more easily damaged by changes in the external environment of the flower.

CHMELAR, Fr. Keimungsverlauf von quellungsunfähigen (harten) Samen bei Rotklee und Luzerne, ausgesät im Keimapparat und auf dem Felde. [Course of germination of hard seed of red clover and lucerne in the laboratory and in the field.] *Bull. Czech. Acad. Agric.* 633.31 : 631.531.1.004.12
 633.321 : 631.531.1.004.12
4. No. 2. 1928.

The author concludes from his experiments that for practical purposes hard seed may be regarded as weaker from the biological and production aspects, and consequently of less value. It will therefore be necessary to restrict this phenomenon in the seed industry by breeding and soil culture (avoiding drying off of soil). This applies more especially to red clover, where it is more pronounced.

CLARKE, A. E. and FRYER, J. R. **Seed setting in alfalfa.** *Sci. Agric.* **11.** 38-43. 1930. 633.31 : 581.141

1. Literature is reviewed, which considers seed setting in relation to the various factors—soil moisture, atmospheric moisture, heat, light, wind, prevalence of tripping agencies, damage by thrips, pollen sterility and variability in the inherent capacity of individual plants to set seed.

2. Untipped flowers enclosed in bags were found to set seed less freely than flowers which were left uncovered. Artificial tripping was found to increase considerably the extent of seed setting and hence the seed yields.

3. Many plants produced high percentages of sterile (empty) pollen grains. The percentage varied among plants, but remained constant for particular plants even when the pollen was produced under different conditions.

4. The variable production of sterile pollen among plants is a matter of important consideration for the plant breeder.—*Authors' summary.*

DANN, Bernhard. Ueber die Befruchtungsverhältnisse der Bastardluzerne (*Medicago media*), anderer *Medicago*-Arten und Steinklee (*Melilotus*). [On fertilisation in hybrid lucerne (*Medicago media*), other *Medicago* species and *Melilotus*.] *Z. Züchtg. A.* **15.** 366-418. 1930. 633.31 : 581.162.4
 633.366 : 581.162.4

(1) Examination of the parent plants confirmed Helmbold's data on the degree of seed setting ability.

(2) For the study of the daughter plants, descendants were reproduced by self and cross fertilisation.

(3) The inheritance of seed setting ability with self and cross fertilisation is, with some exceptions, confirmed. With selfing the seed setting is very much lower, especially in the case of descendants of self-fertilised plants, than with cross-pollination.

(4) The pod number per set head shows inheritance less clearly.

(5) The total grain weight per plant has clearly been inherited. Inheritance may be seen in the descendants of cross-fertilised plants with the same distinctness as in the descendants of selfed plants.

(6) Study of the descendants shows a markedly heterozygous condition of the material as regards seed setting ability.

(7) *Melilotus albus* is autogamous to a very slight degree only, but entirely self-fertile on artificial selfing.

(8) *Melilotus officinalis* is not autogamous. Only a little seed is obtaining by artificial selfing.

(9) Most of the *Medicago* species are autogamous, few are cross-fertilised.

(10) Hybridisation of *Medicago* species with *Melilotus albus* led to no results.

633.31 : 631.531.1.004.12

633.366 : 631.531.1.004.12

DAVIES, P. H. **The effect of high pressure on the percentages of soft and hard seeds of *Medicago sativa* and *Melilotus alba*.** *Amer. J. Bot.* 15. 433. 1928.

High pressure for one minute is effective with hard seeds of *Medicago*.

633.31 : 631.521.5

633.32 : 631.521.5

HILLMAN, F. H. and HENRY, Helen H. **The incidental seeds found in commercial seed of alfalfa and red clover.** *Proc. Int. Seed Test. Ass.* No. 6. 1-22. 1928.

The tables show the results of qualitative botanical analysis of 1000 samples of seed of *Medicago sativa* and 950 samples of *Trifolium pratense*.

The seed examined were the seed of American commerce. It was especially the purpose to examine seed from all the general regions contributing seeds to the American trade in order to determine the kinds of incidental seeds received from these regions, particularly those which are peculiar to each, as a means of identifying the origin of the crop seed.

All the samples of other than American origin were drawn from the importation by the U.S. Customs Service immediately upon its arrival in port and before its release to the importer.

The tables are part of a forthcoming publication from the U.S. Department of Agriculture, which will include, in detail, descriptions and illustrations of most of the different kinds of seeds included in the final list of species.

Before the very extensive list of weed seeds found, the various countries of origin are given and a list of synonyms included.

633.31 : 631.531.1.2

IDAHO EXPERIMENT STATION. **Agronomic work in Idaho in 1928.** [*Alfalfa seed production.*] Idaho Station Bulletin 164. 16-19 and 41-43. 1929.

Satisfactory seed yields of alfalfa in the Palouse region again depended on thin stands, not more than 1 plant per square foot, and the use of first growth. Early seeding of from 8 to 10 lbs. per acre and without a nurse crop is indicated for alfalfa.—*Expt. Sta. Rec.* 61. 822. 1929.

633.31 : 631.531.1] (47)

KOULECHOFF, N. **The characteristics of alfalfa (*Medicago sativa*) seed from Turkestan.** *Proc. Int. Test. Ass.* No. 3. 5-17. 1928.

The name "Turkestan alfalfa" as characterizing a uniform variety is held incorrect, since alfalfa seed samples from various localities in Turkestan differ decidedly in qualities and in content of characteristic foreign matter.—*Expt. Sta. Rec.* 60. 533. 1929.

633.31 : 631.531.1.004.12

IVANOV, Iv. **[Hard seeds of local lucerne (*Medicago sativa* L.)]** *Rep. Bulgarian Bot. Soc.* 2. 1928.

The seeds of local lucerne and foreign strains (Italian, Hungarian and French) were studied. The quantity of hard seed of local lucerne varies from 0 to 62.5 per cent. (an average of 7.4), that of Hungarian from 6 to 37.9, while the maximum number of hard seeds of Italian and French lucerne was 24 per cent. (an average of 11.5). The hard seeds are not distinguishable either by shape or by absolute weight. When stored, the number of hard seeds diminished. On being sown, the hard seeds germinate, though with some delay, and the plants they produce are smaller

in size. In different countries the conception of hard seed is different ; for instance, in France, Italy, Bavaria, Hungary and part of Austria they are regarded as germinable, while in Germany (exclusive of Bavaria), their number is recorded without regard to their germinability. The author assumes that as a rule they may be referred to as germinable seed in Bulgaria in order to avoid misunderstanding in import and export.

633.31 : 631.531.1.004.12

LEGGATT, C. W. **The agricultural value of hard seeds of alfalfa and sweet clover under Alberta conditions.** *Sci. Agric.* **8.** 243-266. 1927.

Grimm alfalfa and sweet clover (*M. alba*) were employed. It was concluded that the hard seeds had practically the same value in number of plants produced as had the permeable. Heavy scarification was detrimental to field germination. Permeable seed gave quicker germination, but the hard seeds were level by mid-summer. Plants from hard seeds appeared more winter-hardy than those produced by the scarified seed. Limited soil moisture and high temperature favoured hard seed germination. An insignificant number of seeds germinated after wintering over in the plots. A new mathematical method for computing the most probable values for the field germination of the hard and permeable seeds is described. The results are then given of the investigation on sweet clover, which was planned in the light of this method.

633.31 : 631.531.12

LEGGATT, C. W. **The comparative value of scarified and unscarified alfalfa seed.** *Sci. Agric.* **8.** 726-728. 1928.

This experiment compared a scarified and an unscarified sample of alfalfa under conditions which were as nearly approaching those on the farm as possible. Stand counts were made at two stations and the comparative yields of green fodder determined at one station. The hard seeds of alfalfa have almost the same power of producing a stand as the permeable. As plants resulting from hard seeds are more winter-hardy, it is concluded that unscarified is as valuable agriculturally as scarified seed.

633.31 : 631.531.12] (43.91)

LENGYEL, G. Provenienzuntersuchungen an ungarischen Luzernesamen. [**A study of the sources of Hungarian lucerne seed.**] *Kísérletügyi Közlemények* **32.** 555. 1929.

Trials have shown that Hungarian lucerne is the best variety for Northern Europe as regards yield and winterhardiness. Examination of samples of Hungarian seed showed that there were about 200 other species represented, together with three fungal species. Samples of 250 gr. were sufficient for this testing. It was possible to distinguish between seed from the Hungarian Plain and the trans-Danube district as regards weed seed content ; this distinction may be of value as the former is the superior variety. Some samples of undoubtedly Hungarian origin contained weed seeds characteristic of Southern Europe, but as the plants are also members of the Hungarian flora, this point is not worth emphasising. Seed possessing *Helminthia* is not considered to be of true Hungarian origin.—*From abstract by C. Shermann. Proc. Int. Seed Test. Ass.* No. 11-12. 144-145. 1930.

633.31+589.42 (Cuscuta) : 581.142.036

MIDGLEY, A. R. **Effect of alternate freezing and thawing on the impermeability of alfalfa and dodder seeds.** *J. Amer. Soc. Agron.* **18.** 1087-98. 1926.

633.31 : 631.531.1.061.1

MILLER, S. C. **Comparative studies of alfalfa seeds of different shapes.** *Proc. Ass. Off. Seed Analysts N. America.* 1925. 14.

Studies of the unit weight, specific gravity, germination, and germination including hard seed, made on 25 samples of selected bean-shaped and selected irregular-shaped seed of alfalfa showed that the specific gravity of the 2 shapes is about the same ; the bean-shaped seed weigh more per 1000 seed ; small-bean shaped seed which weighed slightly more than irregular-shaped seed germinated slightly better than large bean-shaped seed ; and germination including hard seed is definitely better in the bean-shaped seed.—*M. T. Munn. Bot. Abst.* **15.** 1197. 1926.

633.31 : 631.531.12] (43)

633.321 : 631.531.12] (43)

PAULSEN. Die klimatischen Grundlagen des Luzerne- u. Rotkleeamenbaues in Thüringen.
 [The climatic basis of lucerne and red clover seed production in Thuringia.] *Pflanzenbau*.

7. 122-126. 1930.

Farmers in Thuringia are disinclined to use indigenous lucerne seed owing to its higher initial price, in spite of its superiority in longevity. In Thuringia and throughout Germany consumption of lucerne seed greatly exceeds production. Temperature and weather conditions of Thuringia appear suitable for seed production of lucerne. The weather conditions from June to September are described, and the districts suitable for seed production are deduced therefrom.

Red clover is grown to a greater extent than lucerne, owing to comparative cheapness of seed, simpler soil requirements, and its supposed influence on milk yield. Average production of red clover seed is greater than the demand, and it is exported to a considerable extent. The economic possibilities of red clover and lucerne seed production are discussed, and the desirability of increased production of indigenous seed emphasised.

633.31 : 581.141] : 575.12

SOUTHWORTH, W. Influences which tend to affect seed production in alfalfa and an attempt to raise a high seed-producing strain by hybridization. *Sci. Agric.* 9. 1-29. 1928.

The erratic seeding habits of alfalfa are now well known and yet the cultural practices hitherto in use with a view to improve its seeding properties have not met with any marked success. Strains of alfalfa which have been isolated by selection have superior seeding ability to those at present in commerce, but it seems doubtful if a reliable heavy seeding strain can be developed by selection alone.

Experiments and observations made by various workers under widely varying conditions of soil and climate have shown that hand-tripping the flower (i.e., selfing) results in a greatly increased yield of seed. Careful search amongst over seventy strains of alfalfa for a plant with self-tripping flowers met with no success; hence these experiments were designed with a view to try and develop such a plant by crossing alfalfa with the self-tripping Black Medick (*Medicago lupulina*). Alfalfa was used as the female parent and the reciprocal cross was not attempted.

The F₁ and F₂ plants showed great variability, but in general the characteristics of the female parent were predominant. In F₃ (1917) over 20 per cent. of the plants gave an average yield of over 2.5 oz. of seed per plant, the best seeder yielding over 6 oz. None of the progeny of this plant seemed to inherit the good seeding habits of the parent, and one individual was totally sterile, but a large percentage of the flowers were self-tripping. This plant was reproduced by cuttings, and these eventually produced a few seeds from which 35 F₅ plants were raised. In this set one plant had certain flowers, the stamens of which protruded from the tip of the keel; some of these flowers proved to be fertile. In the sixth generation over 4 per cent. of the plants had about 90 per cent. of the flowers with the self-tripping habit; these plants with one exception had flowers which were mostly sterile. The flowers of the fertile plant gave 88.1 per cent. self-tripped flowers, and 59.1 per cent. of these proved to be fertile. From this plant F₇ was produced. Four of these plants, of which the flowers were caged and not tripped, gave an average of 26.6 per cent. fertile flowers; while Grimm alfalfa under caged conditions had only 4.8 per cent. fertile flowers.

Many floral abnormalities occurred.

Of 565 flowers dissected and examined, 79.6 per cent. were normal, 7.7 per cent. had two pistils and 12.2 three pistils; the Grimm flowers examined were all normal and in Black Medick 3.5 per cent. of the 85 flowers examined had three pistils. Shortened pistils intermediate in length, approaching that of the mean of the two parents, were fairly common; and, while no definite correlation could be established between sterility and abnormality, these characteristics seemed to be closely associated.—W.S.

633.31 : 631.521.5

STAEHLIN, A. Untersuchungen an Luzerneproben Thüringer Herkunft. [**Examination of lucerne samples of Thuringian origin.**] *Pflanzenbau*. **6**. 276-281. 1930.

Seventy-four samples were examined for (1) thousand grain weight, (2) foreign matter in general, (3) foreign matter after removal of good clover species, (4) weed content. The dominance and frequency of the individual species was ascertained. Seed was generally obtained from the first cut, but seed from the second cut showed a decrease as regards number and weight of weed species. Less red clover seed was found in seed from older stands. The use of older stands for seed would tend to influence longevity.

633.31 : 581.142.036.1.08

STAKER, E. V. **The effect of dry heat on alfalfa seed and its adulterants.** *J. Amer. Soc. Agron.*

17. 32-40. 1925.

The effect of dry heat on commercial alfalfa seed, on alfalfa seed of different colors, and on certain weed seeds, was studied at Utah Agricultural College. Subjecting commercial alfalfa seed to temperatures between 60° and 90° C. (140° to 194° F.), increased the percentage of germination, 60° seeming as effective as 90°. The higher germination of the heated seed as compared with unheated seed is due to the reduced number of hard seeds. As measured by increased germination, light green or yellow alfalfa seed is more responsive to heating than is brown seed. Much of the inferior seed of alfalfa, i.e., the shrivelled green, dark green, shrivelled brown, light brown, and the dark brown seed probably can be killed by dry heating at 85 or 90°.

Seeds of Russian thistle and white tumbleweed seemed to be completely killed at temperatures of 85° and 90° maintained for four hours, and seeds of sour dock and buckhorn plantain were seriously affected. Tumbling mustard resisted heat the most of any seed tested, and no temperature below 92° seriously impaired the germination of green foxtail. Dry heat at least from 75 to 80°, seems to be especially beneficial to the germination of plantain. Although the results with dodder were rather inconclusive, the author believes it can be successfully controlled by heating alfalfa containing the seed at 80 to 90° for four hours.—*Expt. Sta. Rec.* 53. 135. 1925.

633.31 : 631.531.12] (93.1)

633.321 : 631.531.12] (93.1)

STAPLEDON, Reginald George. **Herbage seed production in New Zealand. II. Red clover and lucerne.** *J. Minist. Agric.* **34**. 328-334. 1927.

It is estimated that 4,000 acres in the Marlborough district were under lucerne in 1916. The leys are grown on an almost ideal lucerne soil, a very deep, rich, calcareous alluvial loam. Many of these leys have been down for twenty years, and seed is quite frequently taken from leys ten to fifteen years old. Seed production from old leys tends to become difficult, as they become very grassy. Improvement may be effected by generous applications of superphosphate and by heavy autumn harrowing with strongly tined implements.

It is a local practice to graze the leys throughout the winter, the supplementary feeding of lucerne hay preventing the ultra-close grazing of the crowns.

The crop is cut when fully ripe, when some of the pods are turning black. A side-delivery reaper is used, carrying is done within eight days, and the crop is usually stacked for about three months before hulling. The yield may be 750-1,000 lbs. per acre. A hay crop always precedes the seed crop.

Leys in Marlborough are, to some extent, now being sown primarily for seed production, and drilling at a somewhat reduced seed rate is advocated for this purpose.

633.31 : 581.142.08

STEWART, George. **Effect of color of seed, of scarification, and of dry heat on the germination of alfalfa seed and of some of its impurities.** *J. Amer. Soc. Agron.* **18**. 743-760. 1926.

Discoloured alfalfa seed is well-known to be inferior to bright-coloured seed. To measure the degree of inferiority alfalfa seed was graded into seven different colour separates and the

germination of each tested on blotters and in sandy loam soil. Taking the unseparated seed as a base at 100 the relative germination in soil of the various colour fractions are :—

(1) True colour, bright olive green, 122. (2) Light green, 100 ; (3) Light brown, 62 ; (4) Dark green, 53 ; (5) Dark brown, 38 ; (6) Shrivelled green, 34 ; (7) Shrivelled brown, 20.

When compared with unseparated bulk seed, true coloured and light brown seeds were heavier, light green seeds were about equal in weight, and all discoloured seeds were noticeably lighter. Green seeds of any shade were lighter than the corresponding brown seeds. Discoloured seeds also seemed to germinate more slowly than the brighter coloured fractions.

Scarified seed gave a higher percentage germination than did unscarified seed in the proportion of 132 : 100.

Dry heat up to 85° C. applied during a period not to exceed four hours, increased the germination by causing most of the hard seeds to germinate. Discoloured seeds were injured considerably at a much lower temperature than were bright mature seeds. It seems probable that the seeds of dodder and Russian Thistle might be largely or entirely eliminated from alfalfa seed by the application of dry heat. No attention was given to the devising of commercial apparatus.—*W.S.*

633.31 : 631.531.12

WALDRON, L. R. **Alfalfa seed production.** Paper prepared for the Seed Growers' School. Fargo, North Dakota. January 15—17. 1929. pp. 5.

V. SOIL.

CARLSON, F. A. **The effect of soil structure on the character of alfalfa root-systems.** *J. Amer. Soc. Agron.* **17.** 336-345. 1925. 633.31 : 581.43] : 631.4

Experiments were conducted in field plats, in tanks, and in water cultures. The varieties and strains of alfalfa studied include Grimm, South Dakota, Common, Kansas Common, Siberian, and Baltic.

The field plat experiments were conducted for 29 months on four different classes of soil ; clay loam, sandy loam, gravelly sandy loam, stony loam.

Results showed that in compact soil all varieties and strains developed branch roots, while in open soil the tap-roots predominated.

(1) Grimm alfalfa is characterized by broad deep-set crowns and numerous fibrous roots ; (2) the northern-grown and southern-grown common alfalfas have similar root features, i.e., small high-set crowns and few fibrous roots ; (3) the Baltic and Siberian compare favourably with the characteristics of Grimm ; (4) the distinctive characteristics of alfalfa roots do not develop until after three to four months of normal growth ; (5) the results of the water culture experiment confirm those obtained under field conditions.

Results seem to indicate that Grimm and Common, as representatives of the hardy and non-hardy alfalfas respectively, have inherent root characteristics and that the nature of the soil structure determines the degree of root branching.—W.S.

DULEY, F. L. **The effect of alfalfa on soil moisture.** *J. Amer. Soc. Agron.* **21.** 224-231. 1929. 633.31 : 631.432

Soil moisture determinations to a depth of 10 feet were made at the Kansas Experiment Station during the seasons of 1926 to 1928 on upland in alfalfa since 1910 and also on land in a 16-year rotation including four years of alfalfa.

When the alfalfa was on the land the moisture content of the deep subsoil was reduced to a low point and remained almost constant. With most of the rainfall coming during the growing season, the moisture penetrated very slightly below a depth of 6 feet and was used by the crop about as fast as it came. When the alfalfa land in the 16-year rotation was broken and kept in corn and wheat for 10 years, the deep subsoil did not gain materially in moisture. On a field in alfalfa for 18 years which was broken out early in June, 1928, and fallowed until August, both the soil and the deep subsoil gained rapidly in moisture, whereas other land carrying a crop made no concurrent gain. At least a short period of fallowing would seem valuable to conserve moisture for starting alfalfa.—*Exp. Sta. Rec.* 61. 519. 1930.

GRANTHAM, George M. **Fertilizer aids alfalfa on sandy soil. Best results obtained by drilling plant food before seeding crop.** *Quart. Bull. Mich. Agric. Expt. Sta.* **12.** 150-151. 1930. 633.31 : 631.411.1

For the production of satisfactory crops of alfalfa, light sandy soils are usually deficient in one or more elements of plant food and often in need of lime. This class of soil should always be tested for lime as such land usually requires from two to three tons of limestone per acre. Fertilizers are also frequently as essential as lime. Phosphate and potash are effective, especially when used in a mixture of equal quantities at the rate of 250 lb. to 300 lb. per acre. Nitrogen either alone or in combination has not given profitable crops in these experiments. On a sandy loam the following yields of hay per acre were obtained from an average of fifteen cuttings :—Lime alone, 1,533 lb., Lime and phosphate, 1,849 lb., Lime and phosphate and potash, 2,125 lb.

It was found that the best method of applying the fertilizer was to drill it with an ordinary grain drill as deeply as possible before sowing the seed. During severe winters it was found that alfalfa on the land which received potash withstood heaving much better than where it had been omitted.

In top-dressing alfalfa the above mixture of fertilizers with lime is recommended in preference to barnyard manure, which may be used more effectively on other crops. This manure is usually well-stocked with various bad weed seeds which may grow and prove a source of infinite trouble to the stand of alfalfa.—W.S.

633.31 : 631.415.1

HAASTERT, Hellmuth. Ueber das Pflanzenwachstum auf sauren Böden. [**Plant growth in sour soils.**] *Z. Pflernähr. Düng. Bodenk. A.* **9.** 265-314. 1927.
The growth of lucerne, serradella and lupin in sour soils.

633.31 : 631.411.9

HAMBLYN, C. J. **Lucerne in Whangarei district. Successful establishment on volcanic land.** *N.Z. J. Agric.* **39.** 253. 1929.

The crop has been successfully established on a fair-quality volcanic loam, overlying a stiff and somewhat hard clay subsoil about 18 ins. below the surface and several feet in depth. Instructions as to the care and management necessary to obtain an average of three or four cuts per annum are given. *Poa pratensis* and *Paspalum* are the worst weeds.

633.31+633.366 : 631.4

HOLTZ, M. F. and SINGLETON, H. P. **Comparative value of alfalfa and sweet clover on soils in the Lower Yakima Valley.** *J. Amer. Soc. Agron.* **17.** 326-333. 1925.

A comparative study was made of the carbon dioxide evolution and nitrate nitrogen accumulation in irrigated soils that had and those that had not grown alfalfa and sweet clover, in soils that had not grown legumes and soils to which legume hays were added as a fertilizer, and in alfalfa and sweet clover land.—*From Authors' summary.*

633.31 : 631.415

KARRAKER, P. E., KENNEY, Ralph, and McKENNEY, H. F. **The soil reaction of fields growing alfalfa and the use of field tests in its determination.** *J. Amer. Soc. Agron.* **19.** 351-356. 1927.

The soil of alfalfa fields which had never been limed was tested by three methods ("Richor-poor" solution, "soiltex" and litmus paper) to discover which test could be used to determine need of liming. The frequency of their yielding acid tests on the surface soil tend to lessen materially their value for this purpose.

The surface soils ranged in pH value with one exception from 6.0 to 7.6. In the surface soils with the lower pH value, lower strata were studied, indicating basic or neutral pH value within a depth of 36 ins.

633.31 : 631.432

KIESSELBACH, T. A., RUSSEL, J. C., and ANDERSON, Arthur. **The significance of sub-soil moisture in alfalfa production.** *J. Amer. Soc. Agron.* **21.** 241-268. 1929.

The relations of alfalfa to subsoil moisture were studied at the Nebraska Experiment Station on meadows of different ages and conditions of cropping, fields growing cereals for various periods since breaking up from alfalfa, and fields never cropped to alfalfa. The soil is mainly Carrington developed on Kansas drift, the surface a clay loam quite receptive to moisture, the subsoil of the second and third foot a tight clay, and the subsoil below this level a friable silt distinctly free of gravel and resembling loess to at least 35 feet deep.

Alfalfa drew upon subsoil moisture to a depth of 33 feet, in a 6-year-old meadow and 25 feet in a 2-year-old meadow. At the end of 6-, 3-, and 2-year periods of growth in three upland meadows the free water content had been reduced to about 2.5 per cent. to depths of 25, 15, and 7 feet respectively. Between the fifth and fifteenth foot in the 6-, 3-, and 2-year-old meadows the average moisture content has been reduced 11, 10.6, and 9.4 per cent. respectively, below

that in adjoining cultivated fields. A 6-year-old alfalfa meadow produced most in the third year, with 7.2 tons of cured forage per acre, but yields thereafter were curtailed by subsoil moisture depletion averaging 2 tons during the fifth and sixth years. Irrigation of part of this meadow in the sixth year brought the yield up to 6.72 tons for the season, compared with 2.35 tons without irrigation, indicating that the shortage of production was due to moisture deficiency.

During 15 years of cropping to cereals after breaking up established upland alfalfa meadow, little moisture had accumulated beyond the seventh foot. The increase in moisture content from the 5- to the 35-ft. level appears to have averaged 0.4 per cent. At this rate nearly 225 years would be needed to restore the subsoil moisture removed by 6 years of alfalfa. Subsoil moisture was replenished more rapidly on low-lying land which received run-off from high ground.

Alfalfa appears to be greatly handicapped on land at some time previously in this crop. In one test a meadow sown 8 years after the previous alfalfa was broken up averaged in three years only 55 per cent. as much as an adjacent meadow not previously in alfalfa. In a similar test started four years later the 2-year average yield was only 35 per cent. as much. These results were found due to deficiency of available subsoil moisture at time of planting.

In a 3-year-old alfalfa field on land which had grown alfalfa once before, undersized tap-roots were found that branched profusely at a depth of about 5 feet into a network of fine roots which were traced to a depth of 14 feet. In a field not previously growing alfalfa the plants had characteristically long, sturdy taproots, with many fine roots throughout the soil mass.—*Expt. Sta. Rec.* 61. 518. 1929.

633.31 : 581.13] : 631.4

MILLAR, C. E. **Studies on the removal of nutrients from subsoil by alfalfa.** *Soil. Sci.* 23. 261. 1927.

Frequent references have been made to the withdrawal of nutrients from the lower horizons of the soil profile by the deep rooting habit of alfalfa.

These studies were undertaken with the purpose of obtaining some definite information as to whether alfalfa, under the conditions of the experiment, actually does remove nutrients from the subsoil and further, whether it is capable of doing so when nutrients are added to the lower soil horizon.

The placing of glass cylinders two inches in diameter and 8 inches long around alfalfa plants (field conditions), thus excluding the roots from the surface soil, did not appear to decrease the growth of the plants as measured by the weight of air-dry tops. Three cuttings were taken for two successive years.

Nutrient solution applied near the tap roots at various depths (by means of an iron pipe) increased the growth of tops of plants enclosed in cylinders. Plants not having their root system restricted by cylinders showed little response to application of nutrient solution.

When nutrient solution was applied to the lower soil horizons a considerable development of fibrous roots occurred in the region of applications.

The individual plants under observation showed a great variation in behaviour as measured by the air-dry cuttings.

Five out of seven plants enclosed in glass cylinders 2 inches in diameter and fifteen inches long filled with quartz sand, lived for two years, three cuttings being taken each year. Two of the plants lived for three years.

When plants with several inches of top growth were enclosed in 15-inch cylinders filled with dry quartz sand at 10.0 a.m. on a bright warm day, no evidence of wilting was apparent at 4.00 p.m. on the following day, which was also bright and warm.—*W.S.*

633.31 : 631.4] (56.61)

MIRIMANOFF, Kh. P. **Influence of alfalfa on the change of virgin soils in the cotton districts of Armenia.** *J. Amer. Soc. Agron.* 22. 97-107. 1930.

633.3 : 631.415.3

NEIDIG, R. E. and MAGNUSON, H. P. **Alkali Studies. II. Tolerance of alfalfa, corn and sweet clover.** *Soil Sci.* 19. 115. 1925.

OLDERSHAW, A. W. **Poor light land and its problems.** *J. Roy. Agric. Soc. England.* 90. 633.31 : 631.415
103-127. 1929.

In East Suffolk a very large area of poor sour light land is practically devoid of lime ; the climate is dry and the conditions as a whole quite unsuitable for the production of good grass.

With a view to preventing or at least checking large areas of this land from becoming totally derelict, experiments were undertaken to see if certain selected farm crops could be grown profitably on this class of land.

In addition to root and grain crops various leguminous crops including lucerne were grown.

The land selected for lucerne was of the poorest quality. Seven half-acre plots in duplicate were laid out. Six of these received applications of lime in various forms and quantities, e.g., chalk, 5-10-20 tons per acre, ceralline crag, 5 tons per acre ; quick lime, 1 and 2 tons per acre, one plot of the seven being left untreated as a check.

The lucerne seed was drilled across the lime and chalk plots at the rate of 20 lb. per acre. In order to test the effect of inoculation the seed was sown in six equal strips across the limed, chalked and untreated plots ; three strips sown with uninoculated seed were alternated with three strips sown with inoculated seed. The inoculating culture was obtained from Rothamsted.

Along with the 20 lb. of lucerne, 1 lb. of perennial rye-grass, 1 lb. of trefoil and 1 lb. of kidney vetch were sown. The seeds came up quickly, but it was soon evident that a satisfactory crop of lucerne was likely to be obtained only on plots where the seed had been inoculated and the land chalked or limed ; one treatment without the other was almost useless.

Where chalk was applied and seed not inoculated the legumes (apart from the lucerne) made some growth ; the lucerne however made little headway, but was better than on the unchalked land.

The trefoil succeeded on all chalked and limed plots and also appeared to benefit considerably from the inoculation of the lucerne. An examination of roots of lucerne plants on the inoculated plots showed an abundance of large nodules whilst the few sickly plants which grew from uninoculated seed had few nodules.

Samples of lucerne herbage analysed at Rothamsted gave the following results :—

Uninoculated plot per cent. nitrogen	1.06
Inoculated " " " " "	2.04

Additional experiments were conducted to test the effect of inoculation on land on which a portion had previously been chalked and the whole area dressed with one cwt. of muriate of potash per acre.

The lucerne seed was drilled in 18 in. rows to allow for cleaning operations.

On the unchalked part the lucerne came up but died off completely ; seed was drilled a second time, but again came up and died off. On the chalked part the seed came up well at first sowing and the crop was horse-hoed as required in 1928-29. About two inches of rain fell on July 4th, otherwise the season of 1929 was extremely dry.

On the chalked portion the crop was cut twice in 1929 and made into hay, the average yield on four plots with inoculated seed being 39½ cwt. and on the two plots with uninoculated seed the average yield was 17 cwt. per acre.

The stand of lucerne is satisfactory and will probably last a number of years. The results as a whole confirm those obtained in the previous trials and show that lucerne can be grown on these poor light soils by the application of chalk and the use of inoculated seed.—W.S.

SEWELL, M. C., LATSHAW, W. L., and TAGUE, E. L. **The effect of acid phosphate on soil reaction and growth of alfalfa.** *Proc. 1st Int. Congr. Soil Sci. Comm. 2.* 439-55. Washington. 1927. 633.31 : [631.85 : 631.415]

Acid phosphate reduces degree of acidity. Highest yields are obtained when lime and phosphate are applied at definite rates.

WEAVER, J. E. **Alfalfa production in a grassland climate.** [Review.] *Ecology.* 11. 452-454. 1930. 633.31 (78.2)

A discussion on the results obtained by T. A. Kiesselbach, J. C. Russel and Arthur Anderson. [*J. Amer. Soc. Agron.* 21. 241-68. 1929.]

VI. FERTILIZERS.

- ALWAY, F. J. and ROST, C. O. **Liming for alfalfa in Southeastern Minnesota.** 633.31 : 631.821] (73) Unvy. Minnesota Special Bull. 107. 1926. pp. 32.
A valuable bulletin dealing with all aspects of the question.

- BARTELS, L. C. **Lucerne top-dressing tests. Results at Tongala and Cohuna.** 633.31 : 631.816 *J. Dept. Agric. Vict.* 28. 641-643. 1930.

The effect of top-dressing irrigated lucerne has been studied. The necessity for top-dressing, the superiority of superphosphate over less soluble manures and the limited value of gypsum have been demonstrated. Yields were increased up to 200 per cent. and a ten-year-old stand shows good density and vigour of growth.

- BARTELS, L. C. and BERULDSSEN, E. T. **Lucerne top-dressing tests.** 633.31 : 631.8 *J. Dept. Agric. Vict.* 25. 558-562. 1927. and 26. 489-491. 1928.

The following table is included in these papers, and shows a summary of yields over four seasons of hay per acre (adjusted to equivalent yields of hay with 15 per cent. moisture) from lucerne top-dressing experiment plots under irrigation at Swan Hill.

SUMMARY OF YIELDS.

Plot.	1924-25.	1925-26.	1926-27.	1927-28.	Average Four Seasons.
	cwt.	cwt.	cwt.	cwt.	cwt.
1. No manure	58.5	61.1	47.8	51.4	54.7
2. Super. 6 cwt.	141.9	176.3	183.0	161.45	165.7
3. Super. 3 cwt.	106.7	146.1	152.6	131.6	134.25
4. No manure	67.8	72.7	57.1	62.7	65.1
5. Super. 2 cwt. p.a.	101.2	123.4	120.2	101.8	111.65
6. Super. 4 cwt. p.a.	122.9	159.1	161.4	139.15	145.65
7. No manure	77.5	83.3	73.3	78.05	78.05
8. Super. 2 cwt., lime 1 ton	112.5	138.35	135.8	115.35	125.5
9. Super. 2 cwt., gypsum 1½ tons	118.5	148.65	139.15	122.4	132.2
10. No manure	74.7	78.25	64.5	70.6	72.0
11. Ground Rock phosp. 2 cwt. p.a.	79.1	83.9	84.1	86.6	83.4
12. Bone fertilizer, 2 cwt. p.a.	87.4	91.1	82.35	79.7	85.15
13. No manure	79.8	71.3	51.25	58.4	65.2

- BROWN, B. A. **Effect of fertilizers on maintaining stands of alfalfa.** 633.31 : 631.8 *J. Amer. Soc. Agron.* 20. 109-117. 1928.

The author gives results from manuring trials with nitrogenous, phosphatic and potash fertilizers.

BRUCE, Oscar G. **The relation of sulphur to alfalfa production.** *J. Agric. Res.* **30.** 937-947. 1925. 633.31 : 631.811.7

The type of soil used contained as much of the common fertilizing elements as the average Kansas soil, with a sulphur content a little above the average. The application of sulphur did not increase yield or root development, indicating that sulphur is not in this case a limiting factor. In general, the acidity of the soil was increased by the sulphur, evidence that it should be supplemented with lime. The nitrogen content of the tops, and the sulphur content of roots and tops were not influenced by the sulphur applied, nor was there any increase in root development or nodulation.

DARGIN, H. J. **A lucerne top-dressing experiment. On the Murrumbidgee Irrigation Area.** *Agric. Gaz. N.S.W.* **41.** 807-808. 1930. 633.31 : 631.816] (94.4)

YIELDS OF $\frac{1}{4}$ -ACRE—LUCERNE PLOTS.

Plot.	Superphosphate per acre.	SEASON 1928-29.		SEASON 1929-30.		Total Period 1928-30.
		Total Yield. Four cuts.	Increase over average of check plots.	Total Yield Three cuts.	Increase over average of check plots.	
		lb.	lb.	lb.	lb.	lb.
1.	Untreated (Check)	5,293	..	2,710	..	8,003
2.	2 cwt. in 1928.	9,022	3,780.5	4,011	1,412.5	13,003
3.	2 cwt. 1928 & 1929.	9,191	3,949.5	5,070	2,471.5	14,261
4.	4 cwt. in 1928.	10,228	4,986.5	4,280	1,681.5	14,508
5.	6 cwt. in 1928.	10,355	5,113.5	4,182	1,583.5	14,537
6.	Untreated (Check)	5,190	..	2,487	..	7,677

DOAK, B. W. **The value of sulphur for fertilization of lucerne.** *N. Z. J. Sci. Tech.* **11.** 25-29. 1929. 631.31 : 631.811.7

The results obtained from analysis of lucerne grown on three soils of widely different properties and subject to different climatic conditions indicate that untreated lucerne shows a range in sulphur content of 0.26 to 0.37 per cent. In two of the three cases, sulphur manuring increased yield. No conclusions can yet be drawn as to whether sulphur content of lucerne will give a reliable laboratory test for sulphur deficient soils, nor can any statement be made regarding the advisability of sulphur manuring. The use of superphosphate will probably meet the demands of the lucerne in this respect.

HALL, T. D. **Lucerne fertilization.** *Farming S. Afr.* **1.** 94-96. 1926. 633.31 : 631.8

The author quotes the results obtained from 1911-1914 on lucerne fertilization by Mr. T. G. W. Reinecke, who emphasised the following points: (1) Superphosphate is the most suitable

phosphate ; (2) there is a progressive geometrical increase in profits per acre when using dressings of 200, 300 and 400 lb. of superphosphate ; (3) 400 lb. per acre applied in August before growth had started, and either before or after the first irrigation, was much more profitable than applying two dressings each of 200 lb., one in August and one after the second cutting ; (4) a 12 tons per acre dressing of kraal manure was more profitable than 8 tons per acre ; (5) superphosphate and muriate of potash gave higher yields than super alone, but profits from super alone were always higher.

Mr. Hall reports on recent investigations. (1) No increase was found by using muriate of potash in addition to superphosphate ; (2) where soil and water are both lime-deficient, dressings of 500-1500 lb. ground limestone per acre will be profitable ; (3) superphosphate gives best yields when applied at a rate of 600 lb. per acre ; (4) the addition of sulphur is of value.

633.31 : 631.816

TENNENT, R. B. **Manurial top-dressing of lucerne. Experiments in Central Otago.** *N.Z. J. Agric.* **39.** 320. 1929.

VII. INOCULATION.

It is thought advisable that this section should not be represented by abstracts. Research workers interested in lucerne from this aspect will find the latest information on the subject in a Technical Communication, written by Dr. H. G. Thornton of Rothamsted, and issued by the Imperial Bureau of Soil Science, Rothamsted Experiment Station, Harpenden, Herts. The references contained in this publication will also be a suitable starting point for anyone wishing to prepare a complete bibliography on the inoculation of lucerne.

Applications for this Technical Communication should be sent direct to the Imperial Bureau of Soil Science.

VIII. MINERAL CONTENT AND NUTRITIVE VALUE.

ALBERT, W. B. **Studies on the growth of alfalfa and some perennial grasses.** *J. Amer. Soc. Agron.* **19.** 624—654. 1927. 633.31+633.2 : 581.143

ASTON, B. C. **Lucerne a lime rich plant. Analyses of Otago samples.** *N. Z. J. Agric.* **38.** 397—399. 1929. 633.31 : 546.41
Chemical analyses show an average calcium oxide content of 3.39 per cent.

DAVIES, W. L. **The proteins of green forage plants. 1. The proteins of some leguminous plants.** *J. Agric. Sci.* **16.** 280—301. 1926. 633.3 : 547.96
Lucerne was among the plants investigated.

DOAK, B. W. **The mineral contents of lucerne.** *N. Z. J. Sci. Tech.* **11.** 108—111. 1929. 633.31 : 581.192
The author treats his subject from three aspects (1) influence of manurial treatment on the chemical composition, (2) influence of season on the mineral content, (3) comparison of feeding-value of lucerne and of pasture. It is concluded that the mineral content of lucerne is considerably influenced by fertilizers and by varying weather conditions. Lucerne is superior to grass mainly in its lime content and may therefore be used to balance a ration otherwise deficient in lime. There appears to be little difference between lucerne and good pasture in the young-growth stage in protein or carbohydrates. The lucerne contains considerably less crude fibre.

FONDER, John F. **Variations in potassium content of alfalfa due to stage of growth and soil type and the relationship of potassium and calcium in plants grown upon different soil types.** *J. Amer. Soc. Agron.* **21.** 732—750. 1929. 633.31 : 546.32
633.31 : 631.4

Stems and leaves and their juice from alfalfa plants grown upon different soil types were analyzed at the Michigan Experiment Station for potassium at several growth stages, and other observations were made on various relations of potassium in the alfalfa plant.

Marked variations in the potassium content of the stems and leaves and of their juice were found due to soil type differences. The potassium percentages were highest in the plants grown upon the light sandy soils, medium in plants from very heavy soils, and least in plants from sandy loams. The potassium content of the plants did not appear to be an exact function of soil texture. More potassium was present in alfalfa stems than in the leaves, while about equal quantities were found in the expressed juice of these plant parts. The percentage of potassium in the stems and leaves and in their juice decreased decidedly with advance in growth. Potassium was present in about equal quantities in the plants of the first and second crops, and the potassium content of the soil apparently was not so depleted at any time that it controlled the potassium content of the plants. The element evidently was not an important cation in determining the specific gravity of the expressed juice of alfalfa stems and leaves, since an increase in the specific gravity usually occurred in spite of a decrease in potassium concentration in the juice.

The potassium in the green material of the alfalfa stems and leaves was largely in solution in the plant sap, and very little was held intimately in the woody tissue. Nearly equal quantities of potassium were in the woody tissue of the stems and leaves, although slightly more was de-

posited in the woody tissue of the leaves by the full bloom stage. In plants from some soil types increasing quantities of potassium were deposited in the woody tissue, while in plants from other soil types a decrease occurred during growth.

Within the alfalfa plants a physiological balance appeared to exist between potassium and calcium. An inverse correlation was established between these elements in plants from the different soil types, an increased calcium content being accompanied by a decreased potassium content, both at different growth stages and in the different plant parts. The potassium and calcium seemed to be interchangeable in the plants, although not necessarily alike functionally. The potassium content of the plants depended upon the calcium content, which in turn, according to indications, appeared to depend upon the available supply of calcium in the soil.—Expt. Sta. Rec. 62. 220. 1930.

633.31 : 581.192

633.31 : 631.4

FONDER, J. F. **A critical study of the influence of soil type on the calcium and magnesium content and other physiological characters of the alfalfa plant.** *Soil Sci.* 27. 205—232. 1929.

Samples of alfalfa (Grimm variety) were obtained from 7 Michigan soil types at 4 stages of growth for the 1st crop and at 3 stages for the 2nd. Samples were analyzed for Ca and Mg in tissue and expressed juice of leaves and stems, for moisture content of tissue and specific gravity of juice. Variations in these characteristics were determined for alfalfa from one soil type at different hours of the day. At one stage of growth the proportion of stems and leaves on the different soil types was ascertained. In addition the amounts of Ca and Mg incorporated in the woody tissue as distinguished from those in the plant sap were determined by a special formula. Soil type influenced very noticeably the Ca content, sandy loam soils giving the largest, and light sandy soils giving the least amounts in the plants; soil texture bore no uniform relationship to the Mg content. The concentration of Ca increased in the tissue and expressed juice in 1st and 2nd growth plants as the season advanced, but the increase was much slower in the 2nd crop, indicating perhaps that the plants were obtaining Ca with greater difficulty. Mg increased with age in the 1st crop, but decreased in the 2nd crop. Soil type influenced the amounts of Ca and Mg in the woody tissue of the plants and also the specific gravity of the expressed juice. Ca and Mg were important cations in determining sp. gr. The characteristics studied varied noticeably at different hours of the day, being least constant between 8 and 12.—Biol. Abs. 4. 1202. 1930.

633.2/3 : 636.085.2

ILLINOIS, Agricultural Experiment Station. Bulletin No. 317. **Relative energy value of alfalfa, clover and timothy hay for the maintenance of sheep.** (pp. 127—167) Urbana, 1928.

633.31 : 581.192

McCOOL, M. M. **The nitrogen content of alfalfa.** *Quart. Bull. Mich. Agric. Expt. Sta.* 8. 122—124. 1926.

Results indicate that if alfalfa is clipped frequently or grazed rather closely, the nitrogen content of the above-ground portions will remain very high. In a trial with three varieties, Grimm, Cossack and a Common variety, a higher nitrogen content was found in the tops and roots of Grimm than in either of the others tested. Cossack took second place.

633.31 : 636.085.2

WEISER, Stephan. Zur Zusammensetzung und zum Nährwert des Luzerneheues. [**The composition and nutritive value of lucerne hay.**] *Forts. Landw.* 2. 78—79. 1927.

IX. WINTER AND DROUGHT RESISTANCE.

FARMING IN SOUTH AFRICA. Winter treatment of lucerne lands. *Farming S. Afr.* **4**. 149. 1929. 633.31 : 631.587] (68.2)

NEBRASKA, Agricultural Experiment Station. Research Bulletin 52. **The relative susceptibility of alfalfas to wilt and cold.** By G. L. Peltier and H. M. Tysdal. Lincoln, Nebraska, 1930. 633.31 : 632.III
633.31 : 632.3

(1) Fifteen earlier introductions of Turkestan alfalfa and 25 lots collected in 1929 by Mr. Westover in six seed-growing districts of Turkestan, together with ten introductions from France and 22 domestic alfalfas, were tested for susceptibility to *Aplanobacter insidiosum*.

(2) The 1929 introductions from Turkestan and France and eight domestic alfalfas were also tested for their cold resistance.

(3) Marked differences in wilt and cold resistance of seed lots collected in various seed-growing districts of Turkestan were found.

(4) Provence F. P. I. No. 34886, Hardistan, some of the old and new introductions from Turkestan, and possibly Ladak were found to be resistant to both wilt and cold.

(5) Grimm, together with a number of other varieties and all domestic common alfalfas tested, were found to be susceptible to wilt.—*Authors' summary*.

OHIO, Agricultural Experiment Station. Forty-ninth annual report 1929-30. Wooster, 1931. 633.31 : 632.II2
The very dry year of 1930, produced some unusual results in the growth of alfalfa roots. Growth of herbage was short and hay yields below normal.

The roots on the other hand showed a marked increase in weight, unusual except in young stands. An average daily gain from May 2nd to June 5th-14th of 34 lb. of air-dry roots per acre per day was indicated as an average of six plots. During this period the increase in weight of roots was half as much again as the increase in weight of hay. These remarkable gains continued at a slightly lower rate for the rest of the season.

The results are stated to be of importance in suggesting a reason why stands of alfalfa are more permanent west of the Missouri River than east of the Mississippi. A higher rainfall is correlated with more active photosynthesis, production of more top growth and less root storage, all these factors tending to reduce the life of an alfalfa stand. It is further suggested that frequent and premature cuttings are not as injurious in the western states as they are in the humid sections.

WEIMER, J. L. **Alfalfa root injuries resulting from freezing.** *J. Agric. Res.* **40**. 121-143. 1930. 633.31 : 581.43] : 632.III

Observations on young Kansas common and Grimm alfalfa plants frozen artificially in the laboratory and naturally in the field confirmed the belief that the cracked and decaying conditions of the crown and upper part of the taproot are the result of freezing. Designating as phloem injury and heart rot the injuries to the tissues lying outside and inside the cambium layer respectively, the two types are discussed. Both injuries developed in potted plants frozen at -6.6° , -8.2° and -11.6° C. for 5, 7 and 4 hours respectively. Phloem injury alone was evident in plants frozen at -11.6° , -13.8° , -14.5° , -17° , -21° and -21° for 3, 6, 7, 4, 2 and 3 hours respectively. Phloem injury, heart rot, or both became evident in 6.9 per cent. of the young plants frozen in soil for 40 days or less. No typical phloem injury or heart rot was produced in plants frozen artificially in the field in summer.

Histological studies of the frozen roots showed a splitting apart of cells, especially along the rays. Micro-organisms commonly associated with typical winter injury are considered for the most part saprophytes or at the best very weak parasites. Inoculation with 5 species of *Fusarium* and 3 of bacteria isolated from typical heart rot and phloem injuries failed to infect unfrozen plants. In the case of moderate injury, the splitting wounds apparently heal during the subsequent growing season.—*Expt. Sta. Rec.* 62. 747. 1930.

WEIMER, J. L. **Some factors involved in the winterkilling of alfalfa.** *J. Agric. Res.* 39. 633.31 : 581.43.036.5.08
263-283. 1929.

X. IRRIGATION.

BARTELS, L. C. **Grading land for lucerne.** *J. Dept. Agric. Vict.* 25. 90-97. 1927. 633.31 : 631.587

With the knowledge that one ton of lucerne hay requires under field conditions 600 tons of water over and above the natural rainfall, the necessity of liberal watering is readily seen. For good results, the preparation of land is of primary importance, the cost of good grading being well repaid. This involves the removal of bumps and ridges which would interfere with the uniform spreading of water, and the filling up of depressions where water would collect and do serious damage. A contour survey is advisable. If land has a gradual uniform slope the field channels for carrying water may run down the slope, the laterals being placed at right angles. With a more rapid slope the land should be divided into fairly narrow bays smoothed well from side to side, and checkbanks at right angles arranged at intervals according to steepness of slope and permeability of the soil. When fall of land is excessive, the checkbanks may be run diagonally across the direction of greatest slope.

On virgin land it is advisable to take a cereal crop after grading in order that the land may settle down before lucerne sowing. Ploughing and through cultivation should be done before grading.

Grading should be thorough, and the position and formation of checkbanks made with great care so as to ensure even distribution of water. A detailed description is given of the crowder implement used in construction of checkbanks ; also other implements in common use for grading such as the buckboard, buckscraper, slicker, road grader, etc.—*W.S.*

BARTELS, L. C. **Watering lucerne.** *J. Dept. Agric. Vict.* 24. 710-715. 1926. 25. 633.31 : 631.587
647-651. 1927.

CANADA, Department of Agriculture. Bulletin No. 125. new series. **Use of irrigation water on farm crops.** By A. E. Palmer. [Alfalfa pp. 17-21 and p. 37]. 1929. 633.31 : 631.587

CONTI, Marcelo. El riego en La Rioja. [**Irrigation in La Rioja**] 633.31 : 631.587] (82) *Bol. Minist. Agric. Nac. Argent. Rep.* **29**. 1-44. 1930.

Experimental studies carried out 1925-28. Alfalfa when irrigated gave 7 cuts, the intervening intervals varying from 35 to 45 days.

JOURNAL OF THE DEPARTMENT OF AGRICULTURE OF VICTORIA. **State Research Farm, Werribee. Irrigation investigations.** 633.31 : 631.587 *J. Dept. Agric. Vict.* **28**. 551-564. [Lucerne, pp. 551-560]. 1930.

At the State Research Farm, Werribee, three ten-acre fields are devoted to irrigation experiments, dealing respectively with lucerne, pasture and grazing tests. The lucerne field contains six sections :—(a) Rate and frequency of watering ; there was an increased hay production as the amount of irrigation water applied was increased, but the increased yield was not proportional to the added amounts of water. With rainfall from 16-19 ins. an additional 18 ins. annual water applied increased the yield from 29 cwt. to 120 cwt. per acre (15 per cent. moisture). Results indicate that six waterings of 4 ins. is the best rate, having regard to economy of watering, and yields, quality and longevity of the lucerne. (b) Spacing of rows test ; designed to test the influence of varying distances between the rows on seed production ; the attempt to produce seed has not been profitable. (c) Time of cutting test shows that hay "cut before blooming" has a higher ash and protein content and a greater nutritive value ; also a lower fibre content, indicating higher digestibility. (d) Renovation tests did not show any benefit from scarifying ; liberal manuring is the most effective means of controlling weeds and maintaining the density of lucerne cut for hay. (e) Variety trials do not prove that Hunter River is of the finest quality ; French Provence is a popular variety, more leafy and finer in stem, its quality probably compensating for its reduced yield as compared with Hunter River. Other types are discussed. (f) Fertilizer tests served to emphasize several points, e.g., the value of soluble phosphatic manure, the value of stable manure, particularly in combination with lime, and the unprofitableness of using nitrogenous or potassic manure.

Lucerne does well at Werribee, yielding up to 6½ tons per acre. 200 acres of carefully graded land has been sown in a series of "bays," from 5 to 20 chains long and from 2/3 to 1 chain wide, the water flowing down each bay in succession.

UNITED STATES DEPARTMENT OF AGRICULTURE. Farmers' Bulletin No. 1630. **Irrigation practices in growing alfalfa.** 633.31 : 631.587 *By Samuel Fortier.* Washington, 1930. pp 26.

Popular description of methods of irrigating alfalfa ; border, check corrugation, sub-irrigation method, flooding from field laterals, irrigating with pumped well water and portable pipes.

XI. TIME OF CUTTING.

633.31 : [581.43 : 581.134]

JANSSEN, George. **The relationship of organic root reserves and other factors to the permanency of alfalfa stands.** *J. Amer. Soc. Agron.* **21.** 895-911. 1929.

633.31 : 631.552

KANSAS STATE AGRICULTURAL COLLEGE. **Experiments relating to time of cutting alfalfa.** By S. C. Salmon, C. O. Swanson, and C. W. Campbell. *Tech. Bull.* **15.** April, 1925.

A review of literature on the subject is given.

The experiments undertaken consisted in cutting alfalfa in four stages of growth ; (1) in flower-bud stage, (2) in tenth-bloom, (3) full bloom, (4) seed stage (in this stage the plots were cut when seed pods were well formed, but before they were matured.)

Results showed :—(1) Cutting in bud-stage produced markedly decreased vigour of growth, stand of plants and yields of hay, and also permitted the encroachment of grasses ; these effects were clearly seen in the second year of the experiments. (2) Cutting the crop in tenth-bloom stage had a similar but a less marked effect and the results were not apparent until much later. (3) When plants were allowed to reach full-bloom stage before cutting, the stand and vigour of the plants were well maintained until the field was eleven years old ; these full bloom plots also produced the heaviest total yield of hay. (4) Cutting the crop in the seed-stage reduced the yield and quality of hay but not the stand or the apparent vigour of the plants. Delayed cutting also resulted in more damage from leaf-spot disease, and the proportion of leaves to stems was materially reduced.

Three years' feeding tests showed that the feeding value of alfalfa decreases considerably with delayed cutting. For feeding beef steers, the best hay was found to be that cut in bud-stage and the poorest that which was allowed to reach the seed-stage.

Considering all the factors it is doubtful if it is wise to cut alfalfa earlier than tenth-bloom stage. It is suggested that cutting might safely begin at this stage and be completed by the time the later crops have reached full-bloom stage, and the hay from the later cuttings be used for horse feed.

In absence of definite experiments an alternate method is indicated, viz., to cut the first crop early when in bud-stage, or tenth-bloom, and postpone the cutting of successive crops in the same season until about the full-bloom stage so as to allow the plants time to recover vigour of growth and so overcome any damage which may have been caused by the early cutting of the first crop.—W.S.

633.31 : 636.085.2

LEUKEL, W. A. **Deposition and utilization of reserve foods in alfalfa plants.** *J. Amer. Soc. Agron.* **19.** 596-623. 1927.

The effects of cutting in the succulent and more nearly mature stages of growth on the root reserves were determined. Frequent cutting when immature causes a continuous reduction of organic root reserves, retards increase in size and weight of roots and decreases the vigour and production of new top growth. Plants cut frequently or late in the season in the succulent growth stages go into winter dormancy low in organic root reserves, high in moisture, and may suffer severe winter injury. This is not found in plants cut when mature and not late in the season.

633.31 : 581.143] : 631.552

NELSON, N. T. **The effects of frequent cutting on the production, root reserves, and behaviour of alfalfa.** *J. Amer. Soc. Agron.* **17.** 100-113. 1925.

The stored organic foods of certain plants have been recognized to have an influence on their productivity.

With favourable soil and climatic conditions the growth of new shoots and stems of alfalfa is largely dependent on the organic food reserves remaining in the root and crown when the last cutting is made. To initiate new stem and leaf growth the storage materials must be translocated from the root to the rapidly growing young stems. This continues until the stems have developed leaf area sufficient to meet the food requirements of growing parts. The early growth of alfalfa stems tends to exhaust the root reserves, hence the primary cause of root exhaustion is a removal of the leaves and stems before they have had opportunity to replenish completely these losses. Chemical and physiological data on alfalfa indicate a more or less definite inter-relationship between the stage of top development (succulence and maturity of growth) and the depletion or restoration of organic root reserves. The replenishing of a root-storage deficit in alfalfa is accomplished by the photosynthetic activity of the plant itself, and a certain degree of maturity in the stems must be attained before this loss is fully restored. Cutting the crop too often in an immature stage of growth results in depleted root-reserves. This causes slow recovery and rate of growth after cutting, low yields of hay, increased trouble from weed infestation, and retarded root growth. The immediate effect of frequent and early cutting is an increase in the number of crown buds and shoots, but the average height and total yields of these top growths is much less than with less frequent cuttings at a more mature stage.

Chemical analyses of alfalfa roots and physiological observations show that stored organic foods in the roots of certain plants such as alfalfa have an important influence on their productivity. Both the nitrogen and carbohydrate reserves of the root are decreased by cutting the crop too early.—*From author's discussion and summary.*

633.3 : 631.552

OHIO, Agricultural Experiment Station. Forty-ninth annual report 1929-30. Wooster, 1931.

Experiments on the effect of cutting sweet clover, alfalfa and red clover in the year of sowing are reported on (pp. 47-8).

633.31 : 631.552] : 636.085.2

SOTOLA, J. **Relation of maturity to the nutritive value of first, second and third cuttings of irrigated alfalfa.** *J. Agric. Res.* **35**, 361-383, 1927.

The main purpose of this investigation was the determination of the chemical composition, digestibility and protein utilization of first, second and third cuttings of alfalfa. Each of these three cuttings was studied at the one-fourth, one-half, and three-fourths stages of maturity, and samples grown in 1923 and 1924 were fed to lambs averaging 80 pounds in weight.

The protein content of alfalfa hay decreased and the fibre content was found to increase as the plants matured. The third cutting at the three-fourths stage of bloom contained the least protein. Second cutting (average of all stages) contained the highest percentage of protein, followed by the third. First cutting ranked last.

The calcium content of alfalfa was found to be seven to eleven times greater than its phosphorus content. Plants cut at the one-half bloom stage contained more calcium than similar samples harvested at the one-fourth and three-fourths bloom stages. No relationship between maturity and phosphorus content was observed, nor was there any relationship between the number of the cutting and the phosphorus and calcium content of the hays.

The highest content of digestible crude protein and total digestible nutrients was secured from the three cuttings of hay harvested at the one-half bloom stage.

First-cutting alfalfa hay contained the largest percentage of digestible nutrients per ton followed by the second and third cuttings respectively. Second-cutting hay contained the maximum of digestible crude protein per ton and third-cutting the least.

The highest seasonal yield of total digestible nutrients and digestible crude protein to the acre was secured at the one-half bloom stage. In respect of protein, hay at the one-fourth bloom stage ranked second, while the three-fourths bloom stage ranked second in respect to total digestible nutrients.

With increasing maturity of the alfalfa plants a lower utilization of the crude protein was observed.—*Author's summary.*

WILLARD, C. J. **Root reserves of alfalfa with special reference to time of cutting and yield.** 633.31 : 581.43] : 631.552

J. Amer. Soc. Agron. 22. 595-602. 1930.

Reduction in root reserves, measured as total weight of roots per acre, is correlated with reduction in yield and vigour of growth. There was a regular reserve increase in the "fall" of the seeding year and in the following spring up to the first cutting. Failure to store root reserves between full bloom and seed stage is probably associated with yellowed and diseased leaves. 177 pounds of reserves per acre were lost in recovery after cutting, accompanied by average percentage nitrogen loss of 0.17. The most uniformly important period of root storage is in October, assuming that a considerable top growth has been produced by October 1st. Healthy leaf area and dry weather are favourable conditions for storage of reserves. There is no evidence that the winterhardiness of the variegated alfalfas depend on amount of root reserves stored.

WISCONSIN AGRICULTURAL EXPERIMENT STATION. **Organic food reserves in relation to the growth of alfalfa and other perennial herbaceous plants.** By L. F. Graber, Nelson, N. T., Leukel, W. A., and Albert, W. B. Expt. Sta. Res. Bull. 80. August, 1927. 633.31 : 636.085.2

This Bulletin presents results similar to those of Nelson, N.T.—633.31 : 581.143] : 631.552

XII. GEOGRAPHICAL CONSIDERATIONS.

CUNNINGHAM, Andrew. **The Cultivation of lucerne.** *Scot J. Agric* **11.** 42-50. 1928. 633.31 (41)
 A general article on selection of soil, variety, inoculation, sowing, cultivation and harvesting. Several tables are included in the text, dealing with such subjects as nutritive value of lucerne and red clover hay, the effect of lucerne and clover upon a subsequent oat crop, the pH value of the soil, etc.

BROWN, Dennis. **Lucerne: stray thoughts on its cultivation and use.** *Essex Co. Fmrs' Un. Yearb.* 1930. pp. 140-5. 633.31 : 631.58+636.085.2

LONG, H. C. **Cultivation of lucerne.** *J. Bath W. S Co. Soc. 6th Ser.* **2.** 7-16. 1927-28. 633.31 (42)

The main points to be borne in mind to ensure successful cultivation of lucerne under English conditions are :—

- (1) The land should be of fair depth (not shallow) and be well drained.
- (2) The soil should be in thoroughly good heart and be adequately furnished with lime ; infertile, wet, acid soils cannot be expected to grow lucerne.
- (3) The correct nodule-forming organisms should be present.
- (4) Good seed should be sown ; seed rate 15-20-25 lb. per acre ; varieties suitable for English conditions are Provence, Grimm and Hungarian, Grimm and Canadian Variegated promising well for wet districts.
- (5) Sowing should take place under conditions which are likely to lead to rapid germination and firm hold of the soil by seedlings.
- (6) Cleaning should be done whenever necessary.

FRUWIRTH, C. Wandlungen in der Schätzung der Luzerne und der Technik des Luzernenbaues [Developments in the valuation of lucerne and methods of lucerne production.] *Landw. Fachpresse Czechoslow.* **1.** 119. 1929. 633.31 (43)

HILLMANN, P. Die Ausdehnung und Bedeutung des Luzernebaus im Osten und Norden Deutschlands. [The extension and importance of lucerne cultivation in Eastern and Northern Germany.] *Jahrb. Weidew. Futterb.* **10.** 63-73. 1930. 633.31 (43)

The principal requirements for lucerne cultivation in Northern and Eastern Germany are :

- (1) Abundant liming and limey sub-soil.
- (2) A variety resistant to the cold climate.
- (3) The substitution to a certain extent of sand lucerne for seed lucerne in accordance with the water-containing power of the soil. This has not yet been generally agreed upon.
- (4) The urgent necessity of breeders concentrating more and more on the breeding of *media* forms, and, if local seed production is not successful, of transferring some generations of those plants of which seed is desired to a more suitable climate, e.g., Hungary, in accordance with Römer's proposal. It is the usual experience that this course has no lasting effect on the characteristics of the plant.

633.31 (43.7)

CHMELAR, Fr. and MIKOLASEK, Fr. Kulturmethode der Luzerne in der Tschechoslowakei und die Möglichkeiten ihrer Verbesserung. [Methods of cultivating lucerne in Czechoslovakia and possibilities of improvement.] *Bull. Czech. Acad. Agric.* 6. 469-473. 1930.

The Seed Testing Section of the Moravian Agricultural Experiment Station at Brunn received a number of replies to a questionnaire on the cultivation of lucerne in Czechoslovakia, from which the following conclusions were deduced:—

(1) As regards seed, more attention should be paid to indigenous seed, which is so often overlooked. (According to experiments carried out by the Section, the results of which have not yet been published, indigenous lucerne was the best.) Steps should be taken with reference to the cultivation and breeding of indigenous lucerne and sand lucerne.

(2) Sand-lucerne (*Medicago media*) is recommended for growing on high ground and on light soils, especially bred strains, as they are more winter-hardy and are not so exacting in soil requirements (e.g. Old Franconian, Grimm, Crescat's etc.)

(3) The inoculation of seed or of the soil should not be forgotten when lucerne cultivation is begun.

(4) The sowing of lucerne seed by means of a cereal sowing-machine in rows (together with the summer crop, or alone in the cover crop which has already been sown) is especially important in the case of lucerne, because there is more prospect of its coming up then when broadcast.

(5) The drying of hay on stands is of great importance for lucerne hay just as with red clover and should be more commonly practised. In the same way the method of drying lucerne by cocking it in the field should be tried, especially when grown for seed.

(6) It is advisable to grow lucerne in rows 20 to 25 cms. apart with the requisite tilth, on ground which has been cleared of dandelion, etc. (See Fr. Chmelar and Fr. Mikolasek, (p. 9 of this Bulletin.)

(7) It should be investigated whether lucerne stands are not used for too long a period in this country.

(8) With reference to the mixing of grass with lucerne, marsh meadow grass (*Poa serotina*) should be tried, especially where there is a possibility of obtaining artificial irrigation.

(9) When liming, it will be necessary to see that the requisite amount of humus and subsoil is available.

633.31 (47.4)

KLINGE, Ludwig. Luzerneanbau im Baltikum. *Medicago sativa* L. [Lucerne growing in the Baltic Provinces. *Medicago sativa* L.] Reval, 1929. p. 33.

Hungarian lucerne has proved valuable, Provence, Italian and United States seed giving very poor yield. Four cuts are generally obtainable. Early sowing without a cover crop, and slight nitrogenous manuring (40 lb. of saltpetre per acre) are recommended. Crop should be harrowed as soon as possible after each cut. Danish trials gave yields of 31 tons green weight per acre and five tons hay. [N.B. Excessive loss of moisture.]

633.31 (47.7)
633.361 (47.7)

RABINOVICZ, V. M. The study of alfalfas and esparcets under the conditions of the Ukraine. *Proc. U.S.S.R. Cong. Genet., Leningrad*, 3. 453-463. 1929.

The increase in area devoted to fodder crops necessitates the importation of large quantities of lucerne, and it is essential that such seed should be tested as to its suitability for Ukrainian conditions.

A comparison of the chief local types of Ukrainian lucerne is being made with types from other sources. A total of 525 tests of strains from Ukraine, Turkestan and other sources are in progress.

In this study the chief attention is paid to flowering, spring growth, drought and winter resistance, resistance to fungal diseases and productivity.

It is generally assumed that the Ukraine first received lucerne from France. These experiments indicate that Ukrainian lucernes are actually related to the original French (morphologically). There is, however, this physiological difference. Ukrainian lucerne is later to start growth in spring and ceases growth at an earlier date in the autumn, and thus has a shorter growing season than the French lucerne and a longer rest period during winter. This early dormancy in autumn is apparently correlated with increased resistance to winter killing, and has undoubtedly been developed during the acclimatization of the French lucerne in Ukraine.

In these experiments the local Ukrainian lucerne gave the best results, Turkestan being the worst; this variety was also very liable to fungal diseases and to loss of leaves at harvest time.

From the results of these experiments it was concluded that it is unwise to import foreign lucerne seed into Ukraine for general distribution until such seed has been thoroughly tested experimentally so as to ascertain if the type or types are sufficiently productive and resistant to cold and fungal diseases as to be adapted to Ukrainian conditions.—W.S.

633.31 (48.1)

FJELSTAD, Anders. Nogen erfaringer ved lucernedyrkningen. [**Some experiences in the cultivation of lucerne.**] *Tidsskr. norske Landbr.* **36**. 53-55. 1929.

Success was obtained by the writer in sowing down a hardy strain of Hungarian lucerne on a lime-rich, well cultivated soil, inoculated seed being sown about June 10th without a nurse crop. The first cut was taken in August. The strength of root development allowed a sharp cultivator to be taken over the plot in the following spring. Two full crops were obtained in the following summer, cutting being carried out at the beginning of flowering, and the cultivator being used after each cut. Three cuts were obtained in the third summer. In other plots, barley was used as a cover crop. Weeds became troublesome on all plots in the fourth spring after sowing and the fields were ploughed up. The good effect of lucerne on subsequent crops could be noted for several years. Tests were also carried out with a seeds mixture containing clover, timothy and lucerne; this composition was very valuable during drought years, when the lucerne persisted. Subsequently the lucerne died out, and the timothy was used for seed production for several years, excellent crops being obtained.

633.31 (48.1)

UDJUS, Carl. Lucernedyrkning. [**Lucerne cultivation.**] *Tidsskr. norske Landbr.* **36**. 55-58. 1929.

The author advises the use of lucerne in Norway because of its high yields, the suitability of the protein-rich fodder either in the green or dried state, and the soil improvement obtained as a result of its cultivation. Various soils are suitable, but they should be well cultivated, preferably after potato or other root crop, and should have a good subsoil preferably rich in lime. Sowing should be carried out without a nurse crop, towards the end of May. Inoculated seed of Hungarian lucerne should be used, and sown in cloudy weather or in the evening. The field is cut in July, when the weeds are also removed; the subsequent rapid growth of the crop suppresses weed growth. Only one cut should be taken in the first summer, to allow the plant time to prepare for overwintering. In addition to lime, phosphoric acid and potash should be supplied. The number of cuts taken each year should not exceed two. Grazing must on no account be practised.

633.31 (48.5)

ELOFSON, A. Luzernodlingen i svenskt jordbruk. [**Lucerne cultivation in Swedish agriculture.**] *Svenska Betes- o. Vallfören. Årsskr.* **8**. 19-32. 1926.

The author circulated a questionnaire to Swedish lucerne growers, and received the following replies:—

(1) "What soil have you found most suitable for lucerne?"

All adequately drained soil is used; boggy soil and soil containing mould on a non-calcareous subsoil are of no value. The majority prefer a clayey mould.

- (2) "What has your experience been regarding lucerne's requirement in relation to soil drainage?"
Where soil is not naturally drained, drainage is essential; the subsoil should not be acid and impermeable.
- (3) "Which method of sowing do you prefer?"
110 of 160 growers preferred drill sowing, with a distance between the drills of 10-11 cm. or up to 20 cm. to facilitate hoeing. Sowing broadcast with grass is sometimes recommended.
- (4) "Has mixing with cocksfoot any advantages?"
98 of 114 growers replied in the affirmative.
- (5) "Is it advisable or disadvantageous to take more than two cuts per year?"
94 or 129 growers did not consider it advisable. Two cuts are generally taken in Sweden, three or even four in Denmark.
- (6) "How many years do you generally harvest crop from your lucerne leys?"
The reply of the majority was 6-10 years.
- (7) "How does lucerne compare with Silesian clover?"
The great majority considered it superior, especially in clover-sick areas. During the severe winter of 1923-24, 100 of 200 farmers found that lucerne was less winter-hardy than the clover, 77 that both were equal in this respect and 23 that Silesian clover was superior to lucerne.
- (8) "What method of weed control do you adopt?"
90 of 128 growers have found it advantageous to carry out vigorous surface harrowing of lucerne in unmixed stand.
- (9) "What is your opinion as regards grazing of lucerne leys?"
Horses, sheep and tethered animals in general are very harmful. Grazing generally does not appear to be popular, an opinion also met with in Denmark.
- (10) "Do you consider manuring of lucerne advantageous?"
Where the soil is not particularly good heart, abundant manuring with superphosphate and potash salts is necessary before putting down the ley.

633.31 (48.5)

TORSELL, R. Möglichkeiten für Luzerne-Veredelung und Luzerne-Samenbau in Schweden. [Scope for lucerne improvement and seed production in Sweden.] K. Landtbr. Akad. Handl. Tidskr. No. 2. 187. 1930.

Grimm is suitable for Swedish conditions generally, Franconian being good for the south, but there are considerable difficulties connected with seed production, the yield varying from a few lb. to 200 lb. per acre. Frequency of tripping is an important factor, and the susceptibility of the pollen to water is a considerable influence in seed production. Breeding should aim at increased green mass and better seed production, which latter could be improved by an increased tendency to self-tripping, early flowering, increased water resistance of pollen and improved fertility. The methods suggested are inbreeding with subsequent crossing of the progeny and propagation by cuttings.

633.31 (54)

INDIA, Military Farms Department. **Lucerne.** By Major A. E. Crawford. Calcutta, 1929.

Lucerne is dealt with from several aspects, with special reference to Indian conditions. Preparation of the seed-bed, method and time of sowing, manuring, after-treatment, time of cutting and irrigation are discussed. In manurial trials, the superiority of superphosphate was marked, both as regards increased yield, increase in number of cuttings and the ability of the crop to withstand the hot winds before the rains.

In a variety test, all the new varieties gave better results than were usually obtained for the commonly used Neemuch variety, the order of merit being (1) giant upland, (2) Spanish Aragon, (3) Grimm, (4) Spanish Tamata, (5) Provence, (6) Neemuch.

SOMALILAND, Agricultural and Geological Department. Annual Agricultural Report for 1929. 633.31 (67.7)

This report contains reference to the study of certain herbage species on the experimental plots. Lucerne seed from New South Wales was sown and at the time of reporting had formed a uniform stand eighteen inches high. The soil had not been inoculated or manured, and only lightly watered. As a result of these trials, lucerne cultivation may be successful, if undertaken by Europeans, where water exists at less than 30 feet below the surface.

MARAIS, J. D. and STARKE, C. J. **Dryland lucerne in the winter rainfall area.** *Farming S. Afr.* 5. 217. 1930. 633.31 (68)

The growing of lucerne under dryland conditions has proved very successful at the Elsenburg Experimental Farm, attached to the University of Stellenbosch. With careful preliminary treatment as regards tillage, fallowing and manuring, and care of the seedlings in their early stages, lucerne has given excellent grazing for dairy cattle, sheep and pigs from May to July, when succulent feed is scarce. Lucerne grown under this treatment on average soils will produce a moderate yield for from three to five years. The land will then become foul with weeds and should be cropped to non-leguminous crops, e.g., kale, mangels and cereals, for a few seasons, when lucerne may again be grown.

SMUTS, I. J. **Promoting the growth of lucerne.** *Farming S. Afr.* 5. 275-276. 1930. 633.31 (68)

Lucerne invaded by grasses after a few years is probably weakened by unsuitable treatment or conditions. Methods of improvement are discussed.

FRYER, J. R. **Alfalfa as a forage crop for Western Canada.** *Sci. Agric.* 10. 530-538. 1930. 633.31 (71.2)

The author seeks to sketch the historical development of alfalfa as a crop, to point out the place of alfalfa in general agriculture and in the "climax phase" of agriculture in Western Canada, to recall some of the outstanding advantages of alfalfa as a forage crop and to discuss some of the major problems which the growing of this crop presents and the progress that has been made towards the solution of these problems.

ALBERTA UNIVERSITY COLLEGE OF AGRICULTURE. Circular No. 8. **Alfalfa in Alberta.** By James R. Fryer. 1930. pp. 23. 633.31 (71.23)

Grimm alfalfa is recommended for Alberta conditions. The type of land for cultivation and the quality of seed to be sown are discussed. Three methods of inoculation are described for seed treatment where alfalfa is intended for soil which has not in recent years grown alfalfa or sweet clover. Except on irrigated land in Alberta, sowing is advised without a nurse crop. On dry land either the press drill or the ordinary grain drill is suitable for seeding if seed is mixed with twice its bulk of cracked wheat. On irrigated land, broadcast sowing is advised with subsequent harrowing. June 1st-15th is the best time for sowing, earlier with a nurse crop. Ten to twelve lb. per acre sowing rate is advised on dry land, fifteen to twenty lb. on irrigated land. Cutting should be done from about the half-bloom to full-bloom stage. For seed crop it is cut when half to two-thirds of the pods have turned brown or black. The clover huller is generally used for thrashing, and the seed may then be cleaned by the ordinary fanning mill if equipped with suitable sieves.

ONTARIO, Department of Agriculture. Bulletin 346. **Hardy alfalfa.** By W. J. Squirrell. 1929. 633.31 (71.3)

A popular bulletin for Canadian farmers.

633.31 (77.3)

ILLINOIS, Agricultural Experiment Station. Bulletin No. 349. **Growing alfalfa in Illinois.**By *W. L. Burlison, O. H. Sears and J. C. Hackleman.* 1930. pp. 70.

Several aspects of the subject, including general cultivation, selection of strain with special reference to winter-hardiness, and occurrence of diseases.

633.31 (78.2)

KIESSELBACH, T. A. and ANDERSON, A. **Alfalfa investigations.** Nebraska Agricultural

College Research Bulletin No. 36. 1926. pp. 125.

This very comprehensive bulletin deals with the crop as grown in Nebraska. Sections are devoted to such subjects as (1) classification of varieties, (2) field plat technique, (3) varieties and regional strains, (4) cultivation, (5) effect of time of cutting upon yield and quality of hay, (6) top dressing, (7) alfalfa-timothy mixture, (8) seeding practices, (9) alfalfa in rotation, and (10) curing of hay. An extensive bibliography, giving a good introduction into American lucerne literature previous to 1925, is appended.

633.31 (79.4)

CALIFORNIA UNIVERSITY COLLEGE OF AGRICULTURE. **Alfalfa production.** By*B. A. Madson.* Cal. Agric. Ext. Ser. Circular No. 35. 1929. pp. 50.

Alfalfa is the most important field crop in California and is exceeded in crop value by the orange only. The area in 1927 was 1,001,000 acres yielding 4,204,200 tons of hay valued at 52,552,500 dollars approximately £10,500,000.

Value of alfalfa land varies from less than 200 dollars to more than 500 dollars per acre, the average being 350 dollars.

Chief factors affecting yield are climate, soil, and water supply. About 80 per cent. is irrigated and is estimated to require $2\frac{1}{2}$ to 3 acre-feet for maximum yields, costing per acre-foot from 1.50 dollars to 7.50 dollars. Unfavourable soil conditions are poor drainage with a high water table, presence of hardpan, and excessive amounts of alkali, which occur chiefly on poorly drained land and are often associated with hardpan.

The best fertilizers are sulphur, phosphorus and occasionally potash. Lime is not generally required. Barnyard manure is always effective.

Alfalfa in the rotation. No definite system of cropping is followed, but at least two or three years should elapse before an old ploughed sod is again seeded to alfalfa. Preparation of land for irrigation and seed-bed is explained, also time and method of sowing by grain drill in six inch rows using on an average, 15 to 20 lb. of seed per acre. A nurse crop is considered to be rarely necessary or advisable and most attempts at reseeding old stands have been failures. Inoculation of the soil is recommended if being seeded with alfalfa for the first time. The pure culture method is used in preference to inoculation by soil or by soil solution; reasons are given.

The care of alfalfa both in the young state and in established fields is discussed in relation to irrigation and general treatment. The productive life of the crop varies greatly and may be from three or four years to as high as 12 to 15 years; excessive irrigation together with cutting the crop too early seem to be the chief contributing factors in shortening the life of the stand.

For making into hay alfalfa is best cut when about one-tenth in bloom; the curing, baling, storing, measuring stacks, and the market grading of hay are described. Pasturing alfalfa is not particularly injurious if carried out properly. Close grazing should be avoided and the field should be allowed to mature a crop of hay occasionally.

Alfalfa seed production in California is between three million and four million pounds per annum and annual requirements exceed five million pounds. For successful seed-production a proper combination of soil, moisture, and suitable weather conditions are essential and such a combination obtains only in very limited areas. For seed the crop is cut when about two-thirds of the pods are ripe; after drying thoroughly in small bunches the crop is best thrashed with an alfalfa huller; the yields of seed vary greatly, a good average being 350 and 400 lb. per acre, occasionally up to 800 or 1,000 lb. per acre.

The principal diseases of alfalfa are leaf spot, crown wart, root rot, insect enemies, eg., grasshoppers and alfalfa caterpillar. The pocket gopher is the only animal causing serious damage. The estimated cost of producing alfalfa is as low as 6 dollars per ton on some farms and more than 15 dollars per ton on others, the differences in yield and costs of irrigation being mainly responsible for this wide variation in cost of production.—*W.S.*

CLOS, Enrique C. Leguminosae forrajeras de la flora argentina. I. *Medicago* L. [Leguminous forage plants of the Argentine. I. *Medicago* L.] Secc. Prop. e. Inf. Circ. No. 595. Min. de Agric. Buenos Aires, 1926. 633.31 (82)

McCONNELL, Primrose. Broadcasting versus drilling lucerne seed. *N.Z. Fmr.* 51. 1089. 1930. 633.31 : 631.531.2

In small areas where weeds are troublesome, drill sowing is recommended. Broadcasting is advisable in larger areas, but only when the land has been thoroughly cleared of weeds. A greater bulk of forage can be grown in drills, and the stand is more permanent than after broadcasting.

WARD, F. E. Lucerne growing. Notes for Canterbury and North Otago conditions. *N.Z. J. Agric.* 32. 15-25. 1926. 633.31 (93.1)

Information is supplied primarily for New Zealand conditions. On deep silt soils and on limestone country lucerne should be sown through every coulter of the seed drill (7 in. rows); on lighter country and where it is primarily intended for grazing, it should be sown in 14 in. rows. The ground should be prepared well and rolled before sowing; harrowing or rolling should not be done after sowing. Generally, a week or two before sowing, $\frac{1}{2}$ —1 ton of crushed burnt lime per acre should be applied. Seed rate 10 lb. per acre in 7 in. drills or 6—8 lb. per acre in 14 in. drills. The first growth should be well developed before cutting; thereafter cuts should be made when new shoots are showing at the crown.

McKAY, J. G. Lucerne growing in Mid-Canterbury. *N.Z. J. Agric.* 37. 386-391. 1928. 633.31 (93.1)
General notes on the cultivation of lucerne under New Zealand conditions.

MEDLEY, R. N. Lucerne as pasture in Western districts, Cowra Experiment Farm. *Agric. Gaz. N.S.W.* 41. 185-188. 1930. 633.31.033 (94.4)

WHITTET, J. N. Lucerne as pasture in Western districts. Trangie Experiment Farm. *Agric. Gaz. N.S.W.* 41. 182-185. 1930. 633.31.033 (94.4)

These two articles deal with the increasing use of lucerne as pasture in N.S.W. Instructions for the proper conduct of grazing are given and the carrying capacity of typical pastures at the Experiment Farms tabulated.

XIII. BOOK PUBLICATIONS.

- COX, J. F. and MEGEE, C. R. **Alfalfa**. Pub. New York : John Wiley. London, Chapman and Hall. 1929. pp. 101. Price 5s. 633.31
- HEUSER, O. E. Die Luzerne : Eigenschaften, Anbau und Verwertung e. wertvollen Futterpflanze. [**Lucerne : the properties, cultivation and utilisation of a valuable forage plant.**] Pub. Berlin : Paul Parey. 1931. pp. 228. Price 12.50 gold marks. 633.21
- HILL, W. S. **The culture of lucerne**. Pub. New Zealand : Whitcombe and Tombs., Ltd. [n.d.] pp. 280. Price 6s 6d. 633.31
- LEPPAN, Hubert D. **Lucerne culture in South Africa**. (South African Agricultural Series No. 2). Pub. South Africa : Central News Agency, Ltd. 1924. pp. 68. pls. Price 6s nett. 633.31 (68)
- ROTHAMSTED CONFERENCES, I. **The growing of lucerne**. (Contributions by Sir John Russell, H. G. Thornton, A. Cunningham, J. Mackintosh, R. D. Williams, and others.) Pub. London : Ernest Benn, Ltd. 1926. Price 1s 6d. 633.31
- STEWART, George. **Alfalfa-growing in the United States and Canada**. Pub. New York : Macmillan Co. 1926. pp. 517. Price 15s. 633.31 (7)

XIV. RESEARCH STATIONS AND DEPARTMENTS INTERESTED IN LUCERNE PROBLEMS.

In order to economise space in this Bulletin it will be sufficient if we refer readers to our Bulletin No. 5, "Research in progress on herbage plants, forage crop and general grassland problems in the British Empire," being issued shortly, to which the countries interested in lucerne from any of the aspects covered by this Bulletin have supplied information along these lines.

As regards foreign countries, it is not thought advisable to supply a list of workers and stations at the moment. Information as to work in progress and results obtained will appear from time to time in Herbage Abstracts.

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